CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

SEPTEMBER 15, 1943

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

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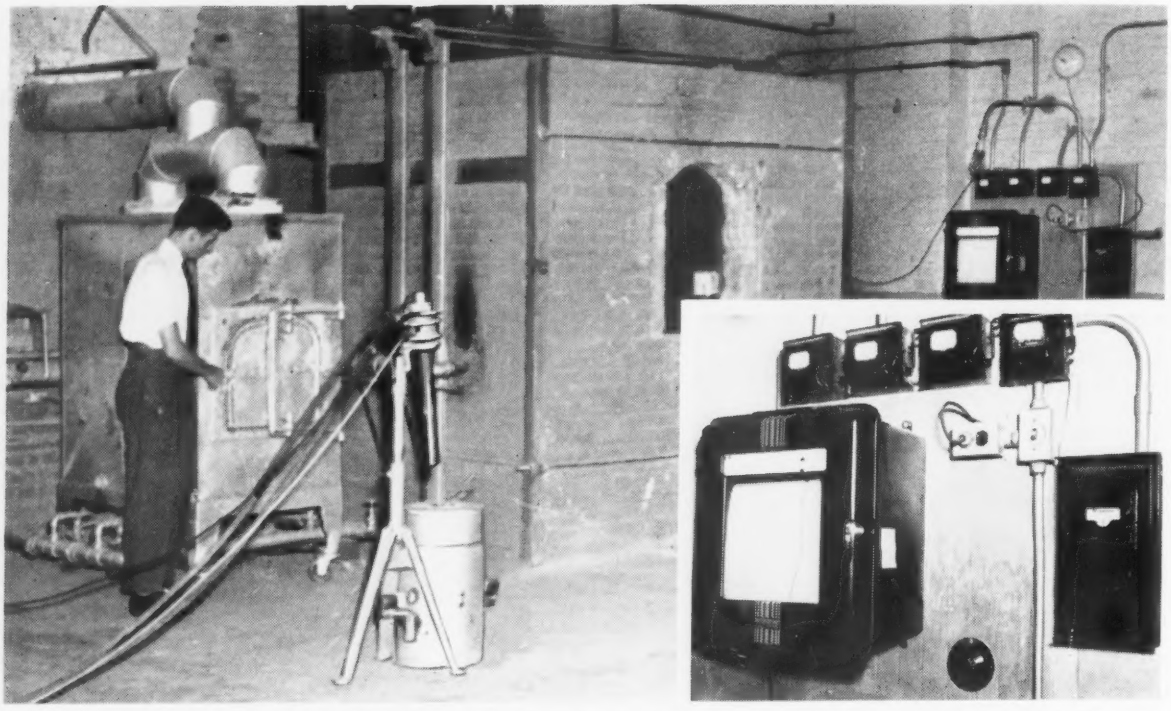

A corner of the laboratory of the Ceramic Engineering Dept., North Carolina State College, Raleigh, N. C. Insert shows their Micromax Pyrometer for either thermocouple or Rayotube.

Effective Use of Micromax Pyrometers In This Ceramic Engineering Lab.

The laboratory shown above has an extremely efficient and economical set-up for measuring the temperatures of its kilns and furnaces, because either a thermocouple or a Rayotube can be switched instantly to the Micromax Pyrometer shown at the right. The Micromax has two ranges; one of 0-3000 F for thermocouples, and one of 1400-3000 F for Rayotubes. Both thermocouple and Rayotube are permanently wired to the pyrometer, and either can be connected by simply throwing the switch. This arrangement would seem to be widely applicable in engineering laboratories.

A typical Rayotube use is in the small cylindrical furnace, where the pyrometric-cone equivalents of refractory materials are determined by ASTM Std. C 24-42. This test requires the material to be heated at consecutively changed rates. Thermocouples have too much lag for this service, and an optical pyrometer has too much "human equation." But the Rayotube, with neither lag nor human equation, solved the problem. In the words of Prof. R. L. Stone, "We follow the ASTM schedule perfectly. It's hard to realize that we used to get along without Rayotubes. Students do better work with them, and Rayotubes also give improved results in industrial consulting."

For a description of Micromax Pyrometers, thermocouples and Rayotubes, see an L&N engineer, or consult Catalog N-33A on thermocouples, or N-33B on Rayotubes.

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TABLE OF CONTENTS

Volume 22 September 15, 1943 Number 9

CERAMIC ABSTRACTS Section

Abrasives 149
Art and Archeology 150
Cements 150
Enamel 150
Glass 151
Structural Clay Products 154
Refractories 154
Terra Cotta 156
Whiteware 156
Equipment and Apparatus 157
Kilns, Furnaces, Fuels, and Combustion 159
Geology 160
Chemistry and Physics 162
General 165

THE BULLETIN Section

Ceramic History

Milman H. Linn, Sr. 301–302

Papers

Control of Atmosphere in Laboratory Kilns
By C. L. Thompson 302–304
Modularia
By Frederick Heath, Jr. 305
ISCC-NBS Color Names
By Dorothy Nickerson 306–10
Dishes and Dining
By Carlton Atherton 311–12

Advertisers' Index 6

Buyers' Guide 16, 22, 23, 24

INDEX TO ACTIVITIES

American Ceramic Society, Special Committee to Consider Cement Division, personnel, p. 314.
Andrews, C. M., to Univ. of Illinois, p. 321.
Autumn Meetings. See *Divisions.*
Bennett, D. G., to Univ. of Illinois, p. 320.
Ceramic Educational Council, committee chairmen for 1943–1944, p. 314.
Divisions, Enamel, Standards Committee report, p. 315.
Materials and Equipment, autumn meeting with White Wares Division, problems to be discussed, p. 316.
Enamels, Government cooperative research at Univ. of Illinois: Andrews, C. M., p. 321; Bennett, D. G., p. 320.
Fellows, minutes of annual meeting, p. 315.
Harter, E. P., appointed general sales manager, Electro Refractories & Alloys Corp., biog., p. 321.
Hartford-Empire Co., resignation of D. E. Sharp, p. 320; A. K. Lyle appointed as successor, p. 320.
Institute of Ceramic Engineers, additional committees, 1943–1944, p. 314–15.
Lyle, A. K., succeeds D. E. Sharp at Hartford-Empire Co., biog., photo, p. 320.
McNamara, E. P., appointed Acting Director, Rutgers Department of Ceramics, p. 321.
Members, new, membership workers' record, roster changes, p. 318.
paid membership and subscription record, p. 317.
service roster, p. 318.
Necrology, Denison, L. A., biog., photo, pp. 322–23.
Fry, L. A., p. 322.
Hare, R. L., biog., p. 322.
Klein, Gordon, photo, p. 323.
Pacific Northwest Clay Manufacturers Association, summer meeting, p. 316.
Photographs, Denison, L. A., p. 323.
Klein, Gordon, p. 323.
Lyle, A. K., p. 320.
Pittsburgh Plate Mirror murals, p. 323.
Sharp, D. E., p. 320.
Thompson, C. L., p. 321.
Whitaker, L. R., p. 319.
Pittsburgh Plate Glass Co., Mirror murals, photo, p. 323.
Rugged individualism, American Association of Engineers, comments on Kilgore Bill, p. 313.
Blake comments, p. 314.
"Private Enterprise" by Benjamin de Casseres, pp. 313–14.
Sharp, D. E., with Libbey-Owens-Ford Glass Co., photo, p. 320.
Structural clay products industry, wartime problems, p. 316.
Thompson, C. L., Chairman, Refractories Division, biog., publications, photo, p. 321.
Whitaker, L. R., Chairman, Structural Clay Products Division, biog., publications, photo, p. 319.

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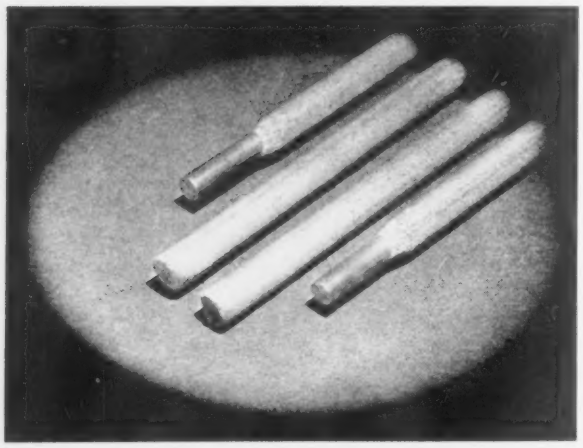

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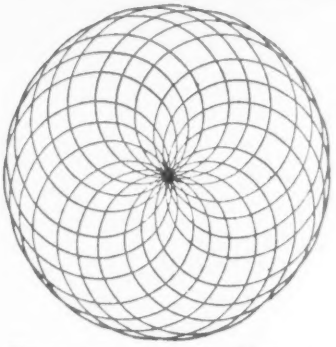
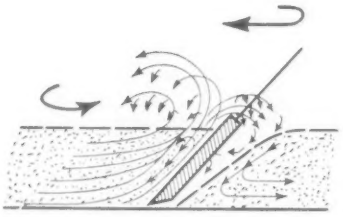
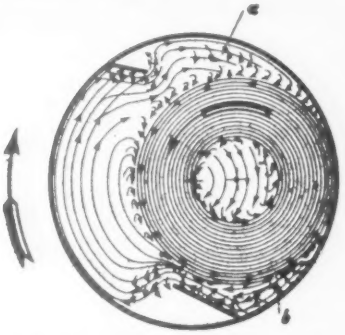


These curves clearly illustrate the paths covered by mixing tools during one revolution of the pan.



The stationary bottom plow is shown turning material around its horizontal axis, in waves, bringing bottom layers to the top.



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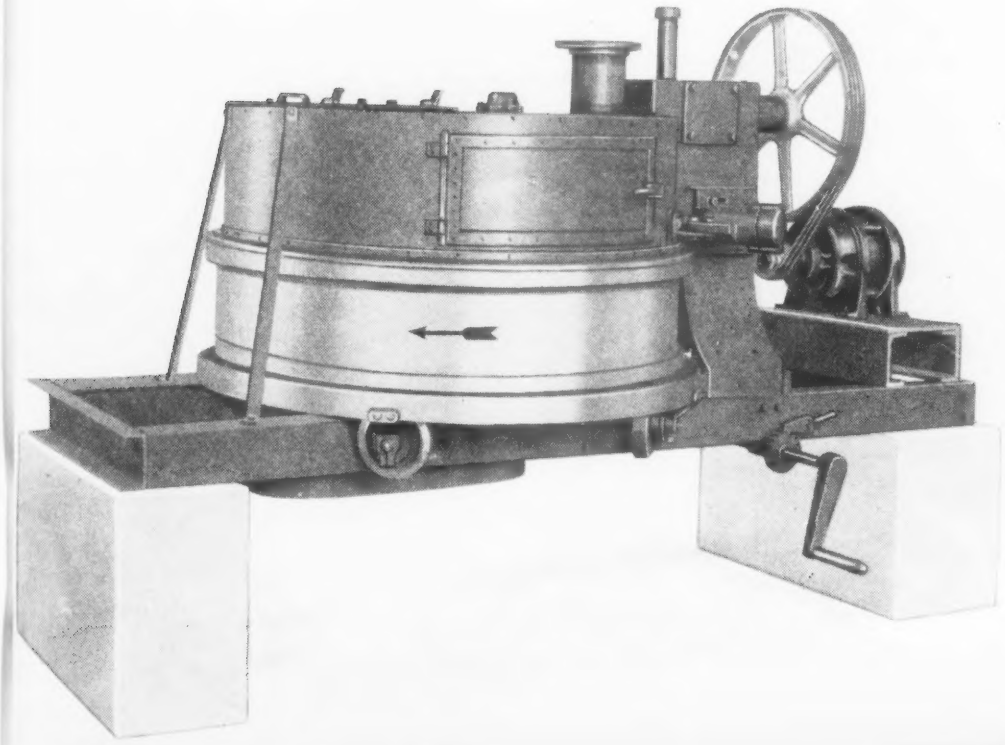

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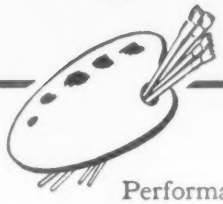

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ALPHABETICAL LIST OF ADVERTISERS

	Page
American Potash & Chemical Corporation	8
American Telephone & Telegraph Co.	26
Bausch & Lomb Optical Co.	10
Buyers' Guide	16, 22, 23, 24
Carborundum Co.	20
Carlson & Associates	10
Classified Ads	4, 10
Clearfield Machine Co.	19
Corhart Refractories Company, Inc.	14
Du Pont, E. I., de Nemours, & Co., Inc.	18
Electro Refractories & Alloys Co.	20
Fate-Root-Heath Co.	11
Felker Mfg. Co.	12
Frazier-Simplex, Inc.	15
Great Lakes Foundry Sand Co.	17
Hammill & Gillespie, Inc.	8
Harrop Ceramic Service Co.	7
Harshaw Chemical Co.	5
Hommel, O., Company	4
Industrial Ceramic Products, Inc.	8
International Pulp Co.	4
Kentucky Clay Mining Co.	19
Lancaster Iron Works, Inc.	2–3
Leeds & Northrup Co.	Inside Front Cover
Maxson, Elwyn L.	21
McDanel Refractory Porcelain Company	8
Metakloth Co.	4
Metal & Thermit Corp.	Outside Back Cover
National Engineering Co.	9
Pacific Coast Borax Company	25
Porcelain Enamel & Mfg. Company	8
Potters Supply Company	25
Proctor & Schwartz, Inc.	8
Professional Directory	21
Solvay Sales Corporation	6
Spinks, H. C., Clay Company	Inside Back Cover
Stauffer Chemical Co.	*316
Swindell-Dressler Corp.	21
Titanium Alloy Mfg. Co.	13
Vitro Mfg. Company	4
Wilson, H. W., Company	25

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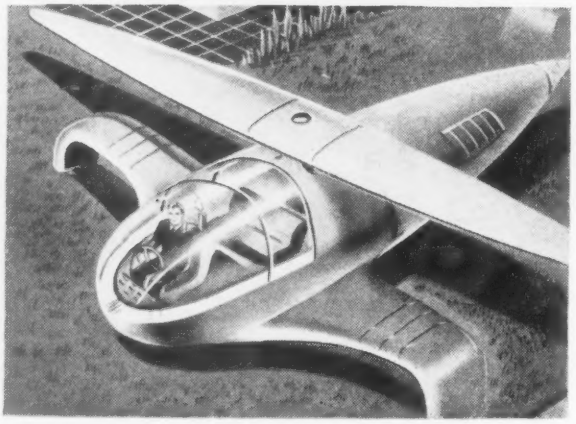

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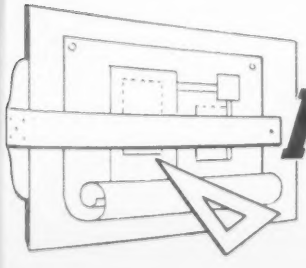

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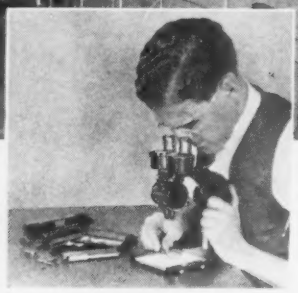

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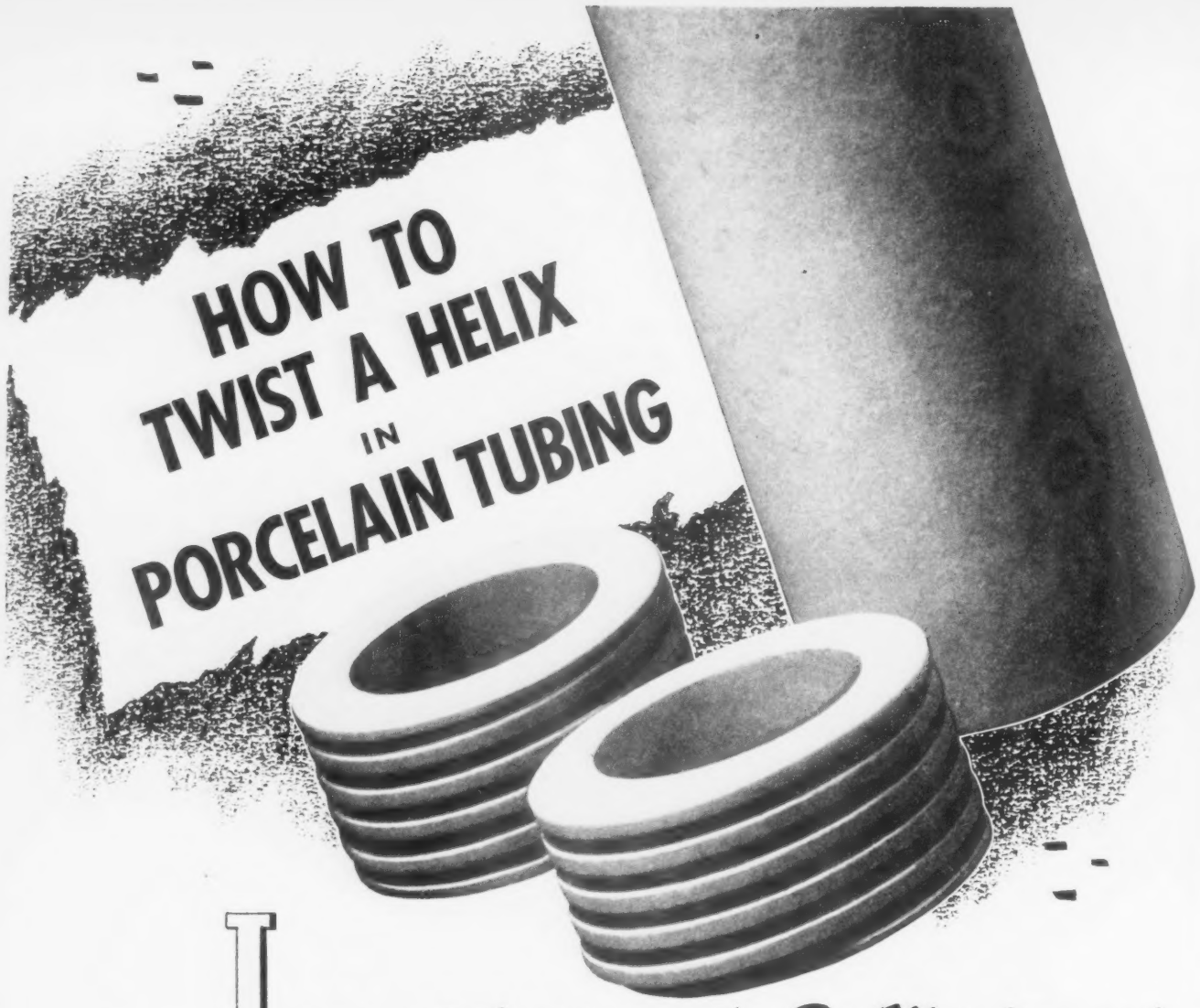

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ILLUSTRATED is a helix *grooved from the solid* in 1⅛" diameter porcelain tubing. This application of DI-MET diamond abrasive wheels was made by chucking the tubing in an ordinary engine lathe, and cutting the groove with the aid of a common tool post grinder. The full depth of 1/16" was cut at a single pass of the diamond abrasive wheel with the lathe spindle operating at a slow speed. Surface finish is excellent and the grooves are clean and well formed.

There are hundreds of uses for DI-MET diamond abrasive wheels in milling, grooving, slicing and notching of all hard, brittle non-metallic* materials. If you work with glass, steatite, ceramics, porcelain, tile, vitrified products, thermo-setting plastics, cement-asbestos, and similar compositions, DI-MET wheels may speed up many of your present manufacturing operations.

***Send a sample of your material*—we will gladly make a report on cutting possibilities. To help us select proper wheel bond and grit size for obtaining desired cutting characteristics, please identify the material and outline the general type of finish required.**

*Metallic Carbides used for cutting tools are an exception. They can be readily sliced, shaped and ground with DI-MET resinoid bonded wheels.

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A 15-Year Record Of Glass Progress

THE statistics below give the performance data of *one* glass furnace through eleven consecutive fires, over a period of fifteen years. It is a story of progress made possible by steady advances in furnace design and operation, and the use of better refractories.

Please note the increases in *life* and *production* —the decreases in *costs*. . . . It is especially significant that despite the wide utilization of more expensive refractories to withstand the abuses of far higher temperatures, the total cost of repairs per-ton-of-glass has dropped more than 60%.

The Corhart Refractories Company is proud to have helped in proving that *a modern glass furnace can turn out tonnages that were impossible in older furnaces—and do it with very large savings in repair costs per unit of glass products.*

Corhart Refractories Company, *Incorporated*, 16th and Lee Streets, Louisville, Kentucky.

PERFORMANCE DATA FOR ONE TANK OVER A PERIOD OF FIFTEEN YEARS

DATE → / MATERIAL IN FURNACE	JAN. '28 JULY '28	SEPT. '28 MAY '29	JUNE '29 APRIL '30	JUNE '30 SEPT. '31	NOV. '31 DEC. '32	FEB. '33 MAR. '34	MAY '34 DEC. '35	JAN. '36 JUNE '37	JULY '37 NOV. '38	FEB. '39 MAR. '41	APRIL '41 JULY '43
	All Clay Tank—13" Sidewalls	All Clay Tank—13" Sidewalls	Corhart Bridge wall 13" Clay M.E. Sidewalls	Corhart Bridge wall 12" thick Corhart Top Course and 13" thick Clay Lower Course M.E.	All Corhart Tank—12" M.E. Sidewalls	All Corhart Tank—12" M.E. and ½ Corhart M.E. Bottom	All Corhart Tank—12" M.E. and ½ Corhart M.E. Bottom	All Corhart Tank—10" M.E. and ½ Corhart M.E. Bottom	All Corhart Tank—10" M.E. and ½ Corhart M.E. Bottom	All Corhart Tank—12" Corhart M.E. and all Corhart M.E. Bottom	All Corhart Tank—12" Corhart M.E. and all Corhart M.E. Bottom
MELTING AREA (SQ. FT.)	834	834	834	834	834	834	834	834	834	834	834
TOTAL DAYS LIFE	212	246	300	482	405	413	600	500	514	738	813
TOTAL OPERATING DAYS	175	201	249	365	320	335	500	427	418	634	738
TONS GLASS DELIVERED	6648	8620	10356	16600	17561	19873	29134	47753	40861	52037	77485
TONS GLASS PER OPERATING DAY	37.99	42.89	41.59	44.93	53.22	59.32	78.27	109.27	97.75	82.08	104.99
SQ. FT. M.A. PER TON GLASS PER DAY	21.9	19.4	20.3	21.8	17.8	16.5	10.7	7.8	8.7	8.2	7.94
TOTAL TONS COAL USED	4732	4810	6215	10540	10680	10208	19154	17176	17757	27179	32338
TOTAL TONS COAL USED ON OPERATING DAYS	3732	4187	5445	8630	9232	8892	17024	16002	15684	24544	30512
BTU PER TON GLASS DELIVERED	103348×10^2	89435×10^2	96802×10^2	86680×10^2	96785×10^2	82371×10^2	80089×10^2	61691×10^2	70865×10^2	86833×10^2	72495×10^2
COAL EQUIVALENT AT 13150 BTU PER LB. (70% PRODUCER EFFICIENCY) (LBS. COAL PER LB. GLASS)	.561	.486	.526	.526	.526	.447	.435	.335	.394	.472	.394
NATURAL GAS EQUIVALENT AT 1000 BTU CU. FT. (PER TON GLASS)	10335	8943	9680	9688	9679	8227	8009	6169	7086	8683	7249
FUEL OIL EQUIVALENT AT 150 000 BTU PER GALLON (PER TON GLASS)	68.9	59.6	64.5	64.5	64.5	54.9	53.4	41.1	47.1	57.9	48.33

NOTE. This tank had a 40' metal line in all campaigns. The ware manufactured was flint containers. The fuel was Island Creek Coal (13,150 BTU per pound).

Ceramic Abstracts Section

Compiled by

THE AMERICAN CERAMIC SOCIETY

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Vol. 22 **September 15, 1943** **No. 9**

Abrasives

Carbide tool grinder. ANON. *Machinery* [N. Y.], **49** [9] 194 (1943).—The Thomas Prosser & Son Model AA carbide tool grinder has many new features of utility and compactness. Illustrated. R.H.B.

Duplex abrasive band and disk grinder. ANON. *Machinery* [N. Y.], **49** [9] 202 (1943).—The Duplex-M-6 pedestal-type grinder recently marketed by the Walls Sales Corp. is furnished with a $^3/_4$-h.p. motor, fully enclosed V-belt drive, balanced steel pulleys, dustproof ball bearings, and Alemite lubricating system. R.H.B.

Jones abrasive-belt backstand idler. ANON. *Machinery* [N. Y.], **49** [9] 204 (1943).—The grinding belt backstand idler made by the Jones Engineering Co. can be easily attached to a lathe drive. R.H.B.

Lempco universal-type tool-post grinder. ANON. *Machinery* [N. Y.], **49** [9] 206 (1943).—A small heavy-duty grinder for internal and external face and taper grinding on lathe, shaper, planer, miller, or bench is a new development of Lempco Products, Inc. R.H.B.

Roan tool and cutter grinder. ANON. *Machinery* [N. Y.], **49** [9] 196 (1943).—A highly versatile tool and cutter grinder, equipped to grind practically all types of milling cutters, has been developed by the Roan Mfg. Co. R.H.B.

Sav-Way internal grinder. ANON. *Machinery* [N. Y.], **49** [9] 200 (1943).—A new internal grinder designed for both hand and hydraulic operation has been brought out by the Sav-Way Industries. See *Ceram. Abs.*, **21** [8] 161 (1942). R.H.B.

Securing fine surfaces by grinding: II. H. J. WILLS. *Machinery* [N. Y.], **49** [9] 169–72 (1943).—Only those troubles that preclude fine grinding and that are due to faulty machines are listed, and the remedies are prescribed. The features listed include inadequate power, poor condition of wheel spindle, vibration, uneven thickness of belts, loose or out-of-balance idler pulleys, backlash in drive gears, loose pulley on the spindle, worn traverse drive parts, misalignment of headstock and tailstock or of wheel head and work, and miscellaneous causes. For Part **I** see *Ceram. Abs.*, **22** [7] 111 (1943). R.H.B.

PATENTS

Abrasive bodies. NORTON GRINDING WHEEL CO., LTD. Brit. 554,226, July 7, 1943 (Nov. 19, 1941).

Abrasive product. N. P. ROBIE (Carborundum Co.). U. S. 2,324,426, July 13, 1943 (Aug. 17, 1940; April 29, 1942).—An abrasive article comprising abrasive grains and a binder therefor comprising the neutralization product of an alkali with a partial polyvinyl ester of a polybasic acid.

Abrasive product. N. P. ROBIE (Carborundum Co.). U. S. 2,324,427, July 13, 1943 (Aug. 17, 1940; April 29, 1942).

Adjustable grinding-wheel dresser. H. W. KROPF (Brickner-Kropf Machine Co.). U. S. 2,324,937, July 20, 1943 (May 3, 1943).

Article-grinding apparatus. J. K. JACKSON (Corning Glass Works). U. S. 2,326,034, Aug. 3, 1943 (Sept. 20, 1941).

Automatic gear grinding machine. FELLOWS GEAR SHAPER CO. Brit. 554,115, June 30, 1943 (Aug. 29, 1941).

Buffing machine. E. E. MURRAY. U. S. 2,325,622, Aug. 3, 1943 (July 3, 1939).

Buffing or polishing machine. E. E. MURRAY. U. S. 2,324,416, July 13, 1943 (April 22, 1941).

Dental tool grinder. J. H. REVELL. U. S. 2,324,025, July 13, 1943 (May 13, 1940).

Free grinding device for steels and alloys. BIRGER EGEBERG (International Silver Co.). U. S. 2,325,180, July 27, 1943 (Nov. 12, 1940).

Gear crowning. R. S. DRUMMOND. U. S. 2,325,836, Aug. 3, 1943 (May 5, 1941).

Grinding, lapping, or polishing machines for diamonds or other crystals. F. C. JEARUM. Brit. 553,890, June 23, 1943 (May 16, 1942).

Grinding machine. G. T. MUSKOVIN AND J. I. GARSIDE (Norton Co.). U. S. 2,324,266, July 13, 1943 (Nov. 12, 1941).

Grinding machine steady rest. H. A. SILVEN (Norton Co.). U. S. 2,324,958, July 20, 1943 (Nov. 19, 1941).

Grinding method applicable to grinding devices and tools. MICROMATIC HONE CORP. Brit. 553,818, June 17, 1943 (April 7, 1941).

Grinding mill. W. F. HELLER. U. S. 2,324,502, July 20, 1943 (Nov. 8, 1940).

Grinding wheel dressing tool. E. L. MEESON AND J. I. MEESON. U. S. 2,324,942, July 20, 1943 (April 9, 1943).

Knife and scissors sharpener. ISAAC WENTES. U. S. 2,324,805, July 20, 1943 (Dec. 5, 1942).

Machines for grinding machine knives. AKT.-GES. DER EISEN- UND STAHLWERKE VORM. G. FISCHER. Brit. 553,972, June 23, 1943 (Dec. 23, 1940).

Machines for grinding metal. D. GILSON & CO., LTD., AND E. BANNISTER. Brit. 553,792, June 17, 1943 (Nov. 29, 1941).

Method and apparatus for spherical grinding. B. I. THOMPSON. Brit. 553,709, June 17, 1943 (Nov. 3, 1941).

Method and means for grinding and polishing surfaces of lenses, prisms, etc. A. T. JORDON AND P. LEVER. Brit. 553,895, June 23, 1943 (June 24, 1942).

Polishing machine. E. E. MURRAY. U. S. 2,325,701, Aug. 3, 1943 (July 22, 1940).

Porcelain bushed grinding wheel. J. F. FISCHER (Abrasive Co.). U. S. 2,324,377, July 13, 1943 (July 23, 1942).—A vitrified abrasive grinding implement and a prefired ceramic insert embedded therein prior to firing of the implement and fused therewith by subsequent firing of the implement.

Precision grinding machines. CHURCHILL MACHINE TOOL CO., LTD., AND H. H. ASBRIDGE. Brit. 553,694, June 17, 1943 (Nov. 19, 1942).

Sandpaper manufacture. J. N. BORGLIN (Hercules Powder Co.). U. S. 2,325,172, July 27, 1943 (Jan. 20, 1942).

Art and Archeology

Cleveland's Annual: a selling proposition. MABEL L. BULLIS. *Art News*, **42** [8] 32–34 (1943).—The quarter-century anniversary of the Cleveland Artists' and Craftsmen's Annual Exhibit proved that in Ohio they not only produce art, they also buy it. Mention is made of the importance of pottery and ceramic sculpture in the exhibit. One of Ohio's basic industries built on Ohio's clay resources has contributed largely to American art in this field. In the American Ceramic Exhibit sent abroad to four countries by the Syracuse Museum in 1937, Cleveland had the largest representation of any American city. Enameling on metal was also prominent in the exhibit; many of the exhibits were ecclesiastical, a significant fact when it is recollected that enameling in the past was a great purveyor to the church. Illustrated. M.E.P.

Control of variations in color. J. J. WENT AND P. KOOLE. *Philips Tech. Rundschau*, **6**, 169–74 (1941); translated in *Chem. Obzor*, **17**, 23–24 (1942); abstracted in *Chem. Zentr.*, **1942, II** [6] 693.—The arrangement of the apparatus permits the control of varnish colors especially. The color of a varnish is measured by determining the coefficient of reflection for four different wave lengths. The use of the method is illustrated by an example. M.V.C.

Tumuli of Bahrein. P. B. CORNWALL. *Asia*, **43**, 230–34 (1943).—There are over 50,000 burial mounds on Bahrein Island in the Persian Gulf. They range from a few feet to 30 ft. high. Pottery found in them is round bottomed, wheel made, and rather well finished. It is usually plain, although some has been scored, as with a comb. It is made of red clay with rarely a red ocher slip. The smaller and earlier tumuli had no metal enclosed. The later ones had bronze from the advanced Bronze Age. The builders must have lived in the second millenium B.C. W.D.F.

PATENT

Multicolor decoration of vitreous objects. H. F. SCHEETZ, JR. U. S. 2,324,433, July 13, 1943 (April 1, 1941).—That method of multicolor decorating vitreous objects which comprises the steps of coating a transfer sheet with suitable sizing, imprinting thereon a multicolor design in the form of a multiplicity of spaced lines or dots, all those for each color being specifically angulated with respect to all for each other color and forming interstices therebetween, successively dusting different portions of the imprinted design separately with different ceramic coloring materials, transferring the coloring materials to a vitreous object, and subjecting the latter to a temperature sufficient to fuse the ceramic coloring materials with the object and expel sizing in the form of gas which passes off through the interstices between the color deposits.

Cements

PATENTS

Acidproof cements and mortars and their preparation. I. G. FARBENINDUSTRIE A.-G. Belg. 428,396, July 30, 1938.—A solution of water glass is used in which the proportion of SiO_2 to water is more than 1:2.5. M.Ho.

Aluminum sulfate metallurgical cement. J. PIRON. Belg. 430,629, Nov. 30, 1938.—A mixture of minerals is so composed that a slag of a strictly predetermined composition is obtained. M.Ho.

Cement. RITTER PRODUCTS CORP. Belg. 428,825, July 30, 1938.—The finely divided crude is passed through an electrostatic field which separates it into several fractions. M.Ho.

Improved cement. M. BEAU. Belg. 433,324, April 29, 1939.—Cement is mixed with ground magnetic iron oxide. M.Ho.

Procedure for making cement and alkali aluminate. I. G. FARBENINDUSTRIE A.-G. Belg. 432,201, March 31, 1939.—A mixture of a substance containing Al_2O_3 and SiO_2 in predetermined proportions and a calcium compound yielding CaO upon calcination is heated at 1250° to 1450°. The calcined material is leached with an alkali-salt solution. The alkali aluminate solution is separated, and the residue is calcined at 1300° to 1500°. M.Ho.

Procedure for manufacturing cement, alkali aluminate, and sulfur dioxide. I. G. FARBENINDUSTRIE A.-G. Belg. 432,466, March 31, 1939.—To a mixture of substances containing Al_2O_3 and SiO_2 in predetermined proportions are added $CaSO_4$ and C. The mixture is calcined at 1250° to 1450°, and the calcination product is leached with an alkali-salt solution. The alkali aluminate is separated, and the residue is calcined at 1300° to 1500°. M.Ho.

Enamel

Concentricity. E. F. HANSEN. *Wire & Wire Prod.*, **18** [3] 170–71 (1943).—A tester utilizing electronic circuits tests 0.001 to 0.006-in. thicknesses of enamel film on round wire 0.025 to 0.065 in. in diameter. B.L.

Development of hot spraying of powdered materials. W. E. BALLARD. *Chem. & Ind.*, **62** [21] 190–94 (1943).—The fundamental idea underlying the process of hot spraying is the projection of powdered material onto a surface through a flame (or a zone of heated gases) to form a coating. The powder may be almost any substance that softens under the influence of heat, such as metal, glass, enamel, thermoplastics, and synthetic rubber. Several spray guns are described. R.H.B.

Enameled Utensil Manufacturers' Council Tentative Standard Impact Test for Porcelain Enameled Cooking Utensils. G. H. ZINK AND A. I. ANDREWS. *Bull. Amer. Ceram. Soc.*, **22** [8] 283–86 (1943).—Four figures.

Enameled utensils. A. I. ANDREWS. *Bull. Amer. Ceram. Soc.*, **22** [8] 282–83 (1943).

Experiments with an accelerated weathering test for porcelain enamels. G. H. SPENCER-STRONG AND W. G. COOPER. *Jour. Amer. Ceram. Soc.*, **26** [8] 249–51 (1943).—2 references.

Future of enameling. B. T. SWEELY. *Bull. Amer. Ceram. Soc.*, **22** [8] 280–82 (1943).

Normalizing production during the introduction of gas opacifying agents in wet enamels with and without boron. KARL DULLIEN. *Emailwaren-Ind.*, **19**, 28–29, 31–34, 37–39 (1942); abstracted in *Chem. Zentr.*, **1942, II** [6] 702.—Control apparatus and methods developed by D.

at his plant are discussed. The outflow time of the enamel slip and the weight of the enamel layer in gm. per sq. dm. were measured; the viscosity and the "staying capacity" of the enamels were also determined with the Irwin consistometer. M.V.C.

Our peacetime industry. CHARLES S. PEARCE. *Bull. Amer. Ceram. Soc.*, **22** [8] 279–80 (1943).

Pickling methods. VIELHABER. *Beizerei* (in *Emailwaren-Ind.*, **18** [47–48]), pp. 23–24 (1941); abstracted in *Chem. Zentr.*, **1942, II** [6] 702.—The advantages and disadvantages of pickling with HCl and H_2SO_4 are discussed. In enamel plants, pickling with HCl is of first importance because the pickling solution can be used cold; the steam required to heat the bath vats when H_2SO_4 pickling solutions are used is seldom available. Clean sheets should not be heated to redness for enameling purposes; instead, they are chemically degreased. Electrolytic pickling is not recommended for enameling. M.V.C.

Resmelting boron-free sheet ground enamels. H. LANG. *Keram. Rundschau*, **49** [6] 58–60 (1941).—On the basis of researches, the following composition is given: glass powder 52, quartz 16, soda 10, fluorspar 8, saltpeter 3, calcite 2, cobalt blue enamel 9. To this are added clay 6 and magnesia 0.5. In grinding, it is much better to add more water than is customary and to drain it off to the right amount after letting it stand a certain length of time. The consistency and staying power of the enamel were satisfactory. The introduction of the Co in the form of a blue enamel (6% cobalt oxide and 8% pyrolusite) proved especially good. The adherence and impact strength of this enamel were also good. M.V.C.

Technical men in the enameling industry. A. I. ANDREWS. *Bull. Amer. Ceram. Soc.*, **22** [8] 278–79 (1943).

The word "enamel." A. THÜRMER. *Glashütte*, **72**, 42–43 (1942); abstracted in *Chem. Zentr.*, **1942, II** [6] 702.—A simplified spelling of the German word for enamel (*Email* and its plural, *Emailen*) is recommended for universal adoption in Germany. M.V.C.

PATENTS

Dry enameling. VEREINIGTE CHEMISCHE FABRIKEN KREIDL, HELLER & CO. NFG. Belg. 433,670, May 31, 1939.—The body of the enamel is made viscous and colloidal to enhance opacification by regulating the quantity of added alkali. M.Ho.

Flux having a silica base and opacified by zirconium oxide. AUERGESELLSCHAFT A.-G. Belg. 430,116, Oct. 31, 1938.—The composition of the flux is so chosen that the absorption of ZrO_2 or the formation of double oxides of Zr with other components is inhibited. M.Ho.

Head for enameled tanks. J. M. FLOYD (A. O. Smith Corp.). U. S. 2,325,497, July 27, 1943 (May 6, 1940).

Opacifier for enamels and its production. SOC. DE PRODUITS CHIMIQUES DES TERRES RARES. Belg. 433,857, May 31, 1939.—The opacifier is prepared from a calcined mixture of MgO and CeO_2. M.Ho.

Opaque vitrified enamels and their preparation. SOC. DE PRODUITS CHIMIQUES DES TERRES RARES. Belg. 434,040, May 31, 1939.—The opacifier is a cerium compound in which the Ce calculated as an oxide is 1.7 to 3.5% and an aluminum compound calculated as Al_2O_3 is 11.9 to 15%. M.Ho.

Porcelain enamel. M. J. BAHNSEN AND E. E. BRYANT (Ferro Enamel Corp.). U. S. 2,324,812, July 20, 1943 (July 25, 1941).—The method of making a porcelain enameled article having an opaque coating which comprises smelting a raw batch mixture of porcelain enamel-forming ingredients characterized by being able to yield from the smelt a frit containing about 10 to 20% ZrO_2 and about 1 to 7.50% of P_2O_5 based on the total weight of the frit, milling a slip containing the frit, coating the ware with the slip, and firing it to yield the opaque surface.

Procedure for making opaque enamels and glass. VEREINIGTE CHEMISCHE FABRIKEN KREIDL, HELLER & CO. NFG. Belg. 433,602, April 29, 1939.—The opacification is induced by gases generated by organic oils or greases incorporated in the body. **Belg. 433,671**, May 31, 1939.—Distillation products capable of giving off a gas, e.g., tar or oil, are added to the enamel. M.Ho.

Procedure for making opaque enamels, especially powdered enamels, with the aid of gas. VEREINIGTE CHEMISCHE FABRIKEN KREIDL, HELLER & CO. NFG. Belg. 433,672, May 31, 1939.—The enamel is freed of ZnO or substances containing it and alkaline-earth bases or substances containing them. M.Ho.

Procedure for preparing cerium compounds for use in enamels. SOC. DE PRODUITS CHIMIQUES DES TERRES RARES. Belg. 433,407, April 29, 1939.—A mixture of hydroxides of trivalent rare earths is oxidized to obtain the cerium as a tetravalent hydroxide. The mixture is then treated with a weak or dilute acid to dissolve the trivalent compounds. The precipitate is washed and dissolved in HNO_3. The CeO_2 thus obtained is used in enamels. M.Ho.

Translucent enamel. AUERGESELLSCHAFT A.-G. Belg. 429,371, Aug. 31, 1938.—A clear pigment having a sulfur base is incorporated into a frit fired at 575° to 850° and free of such metals as Fe, Ni, Co, and Pb. M.Ho.

Glass

Cutting wide-bore glass tubing and repairing partly broken chemical glassware. H. F. TAYLOR. *Chem. & Ind.*, **61** [52] 531 (1942).—A file scratch $^1/_2$ in. long is made at the place where it is desired to cut the tube or cylindrical vessel. Two strips of filter or blotting paper about 1 in. wide and long enough to give 6 to 12 turns around the tube are prepared. The filter-paper strips are saturated with water and wrapped around the tube, one on each side of the file scratch; a space of about 0.3 to 0.35 in. is left between the two rolls of paper. The tube is then rotated as fast as possible by hand, with a batswing gas flame impinging lengthwise on the space between the filter-paper strips, until a crack is seen to travel around the tube. If the two sections do not fall apart, a very slight strain will cause them to do so. R.H.B.

Discussion of "Application of electricity to the annealing of glass bottles and containers." ANON. Abstracted in *Electrician*, **128** [3326] 171–72 (1942).—The paper gave a history and explanatory data on lehrs for bottle and container annealing (see *Ceram. Abs.*, **22** [5] 69 1943)). The discussion brought out the following points: Glass annealed per kw.-hr. varied from 31 to 392 lb. in the same lehr, a 26-oz. mineral bottle requiring 300 kw.-hr. Twenty per cent of the total energy in a glass factory might be used to cool the glass. Strip heaters are preferable to wire windings. Temperature control is easier with electric lehrs than with other fuels. The relative value of fuels was discussed. H.K.R.

Electrical conduction and recrystallization in thin Pb films deposited at low temperatures. EDGAR L. ARMI. *Phys. Rev.*, **63** [11–12] 451–54 (1943).—By evaporation in a high vacuum, thin Pb films were deposited on glass plates cooled by liquid hydrogen. The beginning of electrical conduction was observed in films with a nominal thickness of 7 a.u. Aging of these films at various temperatures revealed the existence of two regions of different behavior, a decrease of resistance below and an increase of resistance above an equilibrium temperature. Possible explanations are offered. G.A.K.

Glass foundation. ALEXANDER SILVERMAN. *Bull. Amer. Ceram. Soc.*, **22** [8] 299–300 (1943); see "Benefits . . . ," *Ceram. Abs.*, **21** [10] 210 (1942).

Manganese carbonate instead of pyrolusite in glass melt. L. SPRINGER. *Glashütte*, **72**, 114 (1942); abstracted in *Chem. Zentr.*, **1942, II** [9] 1047.—The use of manganese carbonate produces yellow brown, a violet color as beautiful as that produced with pyrolusite, and other colors. M.V.C.

Manufacture of opaque glass sheet. RUDOLF HOHLBAUM. *Glashütte*, **70** [15] 194–96; [16] 205–207 (1940); see *Ceram. Abs.*, **21** [10] 210 (1942). M.V.C.

Structural homogeneity of glass. ANIUTA WINTER. *Jour. Amer. Ceram. Soc.*, **26** [8] 277–84 (1943).—12 figures, 4 references.

Study of diffusion in glass. J. A. PASK AND C. W. PARMELEE. *Jour. Amer. Ceram. Soc.*, **26** [8] 267–77 (1943).—10 figures, 21 references.

War plant with glass walls. ANON. *Eng. News-Record*, **130** [8] 288–91 (1943).—A plant to manufacture special war materials required maximum daylight as well as facilities to keep 85% of the building at constant temperature and humidity. The nine-story structure built had reinforced-concrete frame and floors, walls of continuous bands of glass block, fluorescent lighting, and an unusually flexible air-conditioning system. G.A.K.

World's largest optical prism. ANON. *Bausch & Lomb Mag.*, **19** [1] 22 (1943).—The largest prism ever made, an optical glass disk measuring 26 in. in diameter, graduated in thickness from $1^1/_2$ to $3^1/_4$ in., and weighing 260 lb., has recently been cast at the Bausch & Lomb Optical Co. for the Burrell telescope in the Warner & Swasey Observatory of the Case School of Applied Science, Cleveland, Ohio. The prism has a refractive index of 1.617 and a dispersion ratio of 36.6. R.H.B.

PATENTS

Alkali-free glass or a glass poor in alkalis and its use. N. V. MIJ. TOT BEHEER EN EXPLOITATIE VAN OCTROOIEN. Belg. 430,668, Nov. 30, 1938.—An alkali-free glass is made of a mix having the composition lime 16 to 30, MgO 1 to 7, Al_2O_3 7 to 17, and SiO_2 51 to 67%. This glass is used for making fibers which in turn are used for electrical insulation. M.Ho.

Annealing glass sheets and ware. P. B. STRAUSS. Belg. 430,241, Oct. 31, 1938.—To facilitate the division of a piece of glass after it is annealed, constrictions are made in the desired places before the glass is cooled. For this purpose the glass is grooved on one or both sides by mechanical, thermal, or chemical means. M.Ho.

Apparatus for distributing molten glass. SOC. FRANÇAISE DES VERRERIES MÉCANIQUES CHAMPENOISES. Belg. 428,893, July 30, 1938.—Before it reaches the exit orifice, the molten glass passes through a gooseneck channel protruding above the level of the pot in such a manner that when the plunger is released the glass is sucked up and the flow ceases immediately. M.Ho.

Apparatus for glass polishing. PILKINGTON BROS., LTD. Belg. 433,436, April 29, 1939. M.Ho.

Apparatus for joining and fusing glass objects. E. PAUL. Belg. 433,785, May 31, 1939. M.Ho.

Apparatus for making glass thread. SOC. ANON. VETRERIA ITALIANA BALZARETTI MODIGLIANI. Belg. 433,349, April 29, 1939. M.Ho.

Apparatus for manufacturing plate glass. F. FERRE. Belg. 430,557, Nov. 30, 1938. M.Ho.

Apparatus for manufacturing smooth and polished sheet glass. PILKINGTON BROS., LTD. Belg. 432,876, March 31, 1939.—A continuous band of glass travels from the annealing lehr to the hardening apparatus. In the latter, each pair of winding cylinders is equipped with a device which keeps the cylinders at the right tension. This device, which can be either a weight or a spring, is motor driven. M.Ho.

Apparatus for producing a continuous band of polished glass. PILKINGTON BROS., LTD. Belg. 433,272, April 29, 1939. M.Ho.

Apparatus for producing a continuous glass band. PILKINGTON BROS., LTD. Belg. 431,751, Jan. 31, 1939. M.Ho.

Arrangement for annealing sheet and plate glass. A. PREAT. Belg. 430,721, Nov. 30, 1938. M.Ho.

Arrangement for the continuous automatic feeding of furnaces for producing glass fibers. ALGEMEENE KUNSTVEZEL MIJ. N. V. Belg. 433,555, April 29, 1939.—A sheet of glass is kept in contact with the molten glass in such manner that the solid glass melts, thus continually feeding the melting pot. M.Ho.

Arrangement for tapping molten glass in fine streams of varying diameter. VETROCOKE SOC. ANON. Belg. 433,294, April 29, 1939.—The molten glass flows from the melting tank, which is kept at a constant level, onto a spillway and then into grooves or small channels of the desired diameter. M.Ho.

Arrangement for tempering sheets of glass without leaving marks at the places where the sheets are suspended. E. FERLITO. Belg. 430,319, Oct. 31, 1938.—Before tempering, one or more lines are cut into the glass. At these lines the glass is broken to separate the marred places. M.Ho.

Automatically heated glassmelting pot furnace. STEIN ET ROUBAIX SOC. ANON. Belg. 429,169, Aug. 31, 1938. M.Ho.

Automatically heated glassmelting tank furnace. STEIN ET ROUBAIX SOC. ANON. Belg. 429,170, Aug. 31, 1938. M.Ho.

Building unit. E. T. PUTNAM (Libbey-Owens-Ford Glass Co.). U. S. 2,325,800, Aug. 3, 1943 (Nov. 29, 1940).

Continuous process of manufacture of multilayered glass. NEUE GLASINDUSTRIE-GES. M. B. H. Belg. 429,258, Aug. 31, 1938.—A layer of glass is applied to a sheet already drawn. The superimposed glass has a viscosity lower than that of the other. The process is continuous. M.Ho.

Decorating glass, etc. MULTICOLOR FELULETBURKOLO K.F.T. AND E. ELLINGER. Belg. 431,544, Jan. 31, 1939.—The surface to be decorated is covered with the desired color, and the decoration is fired at a high temperature. The decoration is then covered with a varnish which transforms into a bakelite upon heating. The purpose of the bakelite is to protect the decoration. M.Ho.

Device for spinning glass fibers. ALGEMEENE KUNSTVEZEL MIJ. N. V. Belg. 433,643, May 31, 1939. M.Ho.

Device for suspending sheets of glass when they are heated. COMPAGNIES RÉUNIES DES GLACES ET VERRES SPÉCIAUX DU NORD DE LA FRANCE. Belg. 433,060, April 29, 1939. M.Ho.

Drawing plate glass or glass sheet. VEREINIGTE VOPELIUS'SCHE UND WENZEL'SCHE GLASHÜTTEN G.M.B.H. Belg. 429,709, Sept. 30, 1938; addition to Belg. 415,309. M.Ho.

Dressing and polishing of glass surfaces, especially of plate glass. LUMIÈRE ET CLARTÉ SOC. ANON. Belg. 431,049, Dec. 31, 1938. M.Ho.

Electric furnace for the production and treatment of glass. SOC. ANON. DES MANUFACTURES DES GLACES & PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Belg. 432,735, June 30, 1939.—The heating is effected by means of electrodes placed in the lower part of the bath, thus insuring contact with the charge regardless of the level of the bath. M.Ho.

Flashing of foliated glass. A. H. KAMPFER. Belg. 431,555, Jan. 31, 1939.—Foliated glass formed under pressure through a slotted nozzle is laminated at a sharp angle over the underlying sheet of glass. The upper sheet is then applied similarly at a sharp angle and the whole is pressed together. M.Ho.

Flexible molds combined with rigid copes. A. ANTOINE. Belg. 429,228, Aug. 31, 1938.—A pyramid-shaped cope of metal lined with removable flexible walls is especially useful for molding cement. M.Ho.

Frothed structural glass. SOC. ANON. DES MANUFACTURES DES GLACES & PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Belg. 433,763, May 31, 1939.—Reinforcing elements are dipped in the molten glass. M.Ho.

Furnace for treating materials with a high melting point. N. V. MIJ. TOT BEHEER EN EXPLOITATIE VAN OCTROOIEN. Belg. 430,103, Oct. 31, 1938.—The furnace is primarily intended for spinning glass. The various parts of the furnace have a conductivity such that the desired temperature is maintained therein. The parts which make up the orifice from which the glass flows have a higher conductivity than the adjacent parts. M.Ho.

Glass article and method of making. R. H. DALTON (Corning Glass Works). U. S. 2,326,012, Aug. 3, 1943

(March 31, 1941).—The method of making a glass article which includes melting a glass batch containing a reducing agent and a compound of copper, forming the glass into an article, and exposing at least a portion of the article to short-wave radiations.

Glassforming apparatus. J. T. LITTLETON (Corning Glass Works). U. S. 2,326,044, Aug. 3, 1943 (July 20, 1940).

Glass having an expansion lower than that of silica. M. E. NORDBERG (Corning Glass Works). U. S. 2,326,059, Aug. 3, 1943 (April 22, 1939).—A glass which consists of 89 to 95% of silica and over 5% but not over 11% of titanium oxide and which has a coefficient of expansion less than that of silica.

Improved procedure for manufacturing silica fibers, especially quartz fibers. F. SKAUPY AND G. WEISSENBERG. Belg. 429,756, Sept. 30, 1938.—A mixture containing SiO_2 is prepared which can be made into fibers at a temperature lower than pure SiO_2. This mix is used to make an intermediate product which is subsequently treated with acids, acid salts, or other suitable reagents to remove all the constituents except SiO_2. M.Ho.

Improved procedure for tempering glass. GILT EDGE SAFETY GLASS, LTD. Belg. 429,910, Sept. 30, 1938. M.Ho.

Improvement in the heating arrangement of melting baths by electric resistance. SOC. ANON. DES MANUFACTURES DES GLACES & PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Belg. 428,636, July 30, 1938.—The wiring of a glassmelting pot is given. M.Ho.

Improvement in the manufacture of glass fibers. ALGEMEENE KUNSTVEZEL MIJ. N. V. Belg. 433,833, May 31, 1939.—Streams of molten glass are allowed to flow across a blower. The molten glass is thus exposed to the action of a blowing current heated just before it leaves the blower. The body of the blower can be utilized as a resistor for heating the gas. M.Ho.

Improvement in the production of sheet glass. N. V. HOLLANDSCHE MIJ. VOOR DE VERVAARDIGING VAN GLAS. Belg. 433,531, April 29, 1939.—Some improvements in the sheet-drawing apparatus are described. M.Ho.

Installation for manufacturing sheet glass. SOC. ANON. DES MANUFACTURES DES GLACES & PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Belg. 430,404, Oct. 31, 1938.—An apparatus for drawing sheet glass is attached to one large furnace capable of feeding it continuously. At the same time the apparatus, with easy adjustment, can be fed by one or more smaller furnaces. These are used when a small quantity of a special glass is required. M.Ho.

Lens-surfacing device. W. P. CANNING (American Optical Co.). U. S. 2,325,740, Aug. 3, 1943 (May 10, 1941).

Manufacture of machine-molded hollow glassware. H. J. ENGEL. Brit. 554,120, June 30, 1943 (Aug. 19, 1941).

Manufacture of pressed or molded glass articles having one or more transverse holes or passages therein. WOOD BROS. GLASS CO. AND J. MANN. Brit. 554,152, July 7, 1943 (May 20, 1942).

Method and apparatus for annealing glass. SOC. ANON. DES MANUFACTURES DES GLACES & PRODUITS CHIMIQUES DE ST.-GOBAIN, CHAUNY & CIREY. Belg. 428,808, July 30, 1938.—Hollow glassware, e.g., bottles, are annealed in a cooling liquid. To immerse the object in the annealing bath, a vacuum is created within it which makes the cooling liquid rush in and push the object down. M.Ho.

Method and apparatus for felting glass fibers. A. E. EDWARDS (Owens-Corning Fiberglas Corp.). Brit. 554,104, June 30, 1943 (Dec. 17, 1941).

Method and apparatus for producing mineral wool. H. T. COSS (Johns-Manville Corp.). U. S. 2,325,940, Aug. 3, 1943 (July 21, 1937).

Method of etching insignia upon articles of glassware. C. W. GUSTKEY (Imperial Glass Corp.). U. S. 2,324,694, July 20, 1943 (Dec. 11, 1942).

Mineral wool felting apparatus. G. T. PEARCE (Johns-Manville Corp.). U. S. 2,325,975, Aug. 3, 1943 (Nov. 16, 1940).

Mineral wool forming apparatus. NICHOLAS DOBAK AND E. R. POWELL (Johns-Manville Corp.). U. S. 2,324,140, July 13, 1943 (May 21, 1941).

Perfected method for manufacturing glass thread by drawing it from glass bands or felted glass. SOC. ANON. VETRERIA ITALIANA BALZARETTI MODIGLIANI. Belg. 430,925, Dec. 31, 1938. M.Ho.

Phosphate glass. I. G. FARBENINDUSTRIE A.-G. Belg. 428,408, July 30, 1938.—Phosphorus glass contains 8 to 21% by weight of sodium oxide and 5 to 21% of potassium oxide. Part of the boric acid may be replaced by zinc oxide not exceeding 6% of the weight of glass. The alkalis do not exceed 25% of the total weight. M.Ho.

Porous bodies made of glass fiber and a procedure for their manufacture. N. V. MIJ. TOT BEHEER EN EXPLOITATIE VAN OCTROOIEN. Belg. 429,896, Sept. 30, 1938.—The glass fibers in these porous bodies are held together by pure carbon. This is derived by thermal treatment of an organic adhesive or similar substance used originally to bind the glass fibers. These bodies are used as heat insulators, filters, etc. M.Ho.

Procedure and apparatus for cooling glass strips in Fourcault machines. DRAMMENS GLASSVERK. Belg. 430,423, Oct. 31, 1938. M.Ho.

Procedure and apparatus for drawing sheet and plate glass. P. BOLGAR. Belg. 430,639, Nov. 30, 1938.—The apparatus is so arranged that a band of glass is drawn simultaneously lengthwise and broadwise. M.Ho.

Procedure and apparatus for manufacturing frothed glass having a large content of air bubbles. FABIAN & CO. Belg. 430,666, Nov. 30, 1938.—Purified molten glass is frothed by stirring it thoroughly in a beater and at the same time passing through it furnace gases at a temperature equal to that of the molten glass. M.Ho.

Procedure and apparatus for manufacturing glass fibers. N. V. MIJ. TOT BEHEER EN EXPLOITATIE VAN OCTROOIEN. Belg. 430,566, Nov. 30, 1938.—Filaments of molten glass are allowed to flow onto a surface of a heating element heated to a temperature at which the molten glass can be converted into fibers. From this surface, the fluid glass is blown off by jets of gas. M.Ho.

Procedure and apparatus for manufacturing glass thread. OSCAR GOSSLER GLASGESPINST-FABRIK G.M.B.H. Belg. 431,747, Jan. 31, 1939.—The spinnerettes are arranged in a circle at the bottom of a shaft furnace revolving around its vertical axis. The spinnerettes are concentric to this axis. The heating gases are fed into the furnace along the direction of the axis so that the spinnerettes are maintained at an even temperature. M.Ho.

Procedure and apparatus for manufacturing glass tubes by drawing. J. SZANTO. Belg. 430,436, Oct. 31, 1938. M.Ho.

Procedure and apparatus for manufacturing undulated mineral fibers. ALGEMEENE KUNSTVEZEL MIJ. N. V. Belg. 432,563, March 31, 1939.—The fibers are formed from a material which is irregular in its composition or is made irregular during this process. For this purpose, a vitreous material which has a different coefficient of thermal expansion than the base mass is added to the molten mass. In another method the fibers are subjected, while being formed, to the action of agents which remove from them certain components in an irregular manner. M.Ho.

Procedure and apparatus for the production of glass fibers or thread. N. V. MIJ. TOT BEHEER EN EXPLOITATIE VAN OCTROOIEN. Belg. 431,591, Jan. 31, 1939.—Molten glass is allowed to overflow from its container and spill onto an inclined surface, thus forming a layer of desired thickness. This layer is subsequently separated into threads or fibers. M.Ho.

Procedure and apparatus for treating mineral fibers, particularly glass fibers. ALGEMEENE KUNSTVEZEL MIJ. N. V. Belg. 432,562, March 31, 1939.—While the fibers or threads are hot and viscous, they are acted upon by

agents which remove from the fibers either acidic or basic components or which add to the glass certain substances. The purpose of this treatment is to roughen the fibers. M.Ho.

Procedure and arrangements in the manufacture of bands or threads of glass, etc. N. V. Mij. tot Beheer en Exploitatie van Octrooien. Belg. 432,564, March 31, 1939; addition to Belg. 424,672.—The fibers are wound on a rotating staff on which they are pulled along its axis in such a manner that a thread is spun. This thread is used for insulating electrical conductors. M.Ho.

Procedure for blast blowing of fused minerals such as slag to produce mineral wool. Deutsche Eisenwerke A.-G. Belg. 433,527, April 29, 1939.—An inflammable gas mixed with compressed air is used for atomizing the molten mineral. M.Ho.

Procedure for drawing plate or sheet glass. Deutsche Tafelglas A.-G. (Detag). Belg. 433,551, April 29, 1939.—The cooling of the sheet is retarded at the plastic stage. This is accomplished by means of adjustable mechanisms arranged uniformly over the width of the sheet. M.Ho.

Procedure for drawing sheet glass with a Fourcault machine. Deutsche Tafelglas A.-G. (Detag). Belg. 433,739, May 31, 1939.—At least one of the ends of each heating electrode is arranged almost perpendicularly to the discharge slit of the melting bath. M.Ho.

Procedure for making hard glass. Vereinigte Glühlampen und Elektrizitäts A.-G. Belg. 430,428, Oct. 31, 1938.—Part of the constituents of the mix are precipitated from their solutions as colloidal gels. These are mixed with the other constituents in the form of their solution, and the whole is then evaporated to dryness. M.Ho.

Procedure for manufacturing faceted hollow glassware. R. Schwarz. Belg. 433,840, May 31, 1939. M.Ho.

Procedure for manufacturing glass fibers and other thermoplastic materials. Algemeene Kunstvezel Mij. N. V. Belg. 433,832, May 31, 1939.—Molten glass flows into a nozzle at the end of which is produced lowered pressure. As a result, air is sucked into the nozzle in the direction of the flow of the glass. This transforms the molten glass into fibers. M.Ho.

Procedure for treating glass fibers, etc., and the products obtained thereby. N. V. Mij. tot Beheer en Exploitatie van Octrooien. Belg. 429,217, Nov. 30, 1938.—The glass fibers are steeped in a solution containing ions that are absorbed by the components of the glass fibers by virtue of which the fibers acquire new properties. This procedure is applicable for coloring glass fibers and, with special treatment, makes such fibers usable for water sweetening. M.Ho.

Process for dulling glazes. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. Belg. 428,500, July 30, 1938 (June 10, 1937).—In this process oxides of antimony are utilized whose oxygen content is between that of Sb tetroxide and Sb pentoxide. M.Ho.

Protecting the edges of armored glass. Compagnies Réunies des Glaces et Verres Spéciaux du Nord de la France. Belg. 432,572, March 31, 1939.—The edges of armored glass are coated with a molten metal which is only slightly attacked by air humidity and which forms an oxide layer on the surface. The purpose is to enclose the ends of the glass. M.Ho.

Reclaiming used sand. N. S. Garbisch. Belg. 431,692, Jan. 31, 1939.—Sand used for glass polishing is heated in such a manner that the fines are agglomerated. The product is ground to a uniform particle size. M.Ho.

Spinnerette for very fine glass thread. Algemeene Kunstvezel Mij. N. V. Belg. 433,677, May 31, 1939.—The heating element of the spinnerette is a platinum bar placed in the melting zone or near the orifice of the spinnerette. M.Ho.

Utilization of artificial mineral fibers. Deutsche Eisenwerke A.-G. Belg. 430,755, Nov. 30, 1938.—Mineral fibers made of blast-furnace slag or other mineral matter containing little lime are combined with a bonding material and molded. The thickness of the used fibers is generally over 5 μ. M.Ho.

Structural Clay Products

Simplified Practice Recommendation on Vitrified Paving Brick reaffirmed. Anon. *Bull. Amer. Ceram. Soc.*, **22** [8] 271 (1943).

PATENTS

Apparatus for ornamenting brick. L. Bentley and E. Garforth. Belg. 430,200, Oct. 31, 1938. M.Ho.

Coping tile. J. H. Phillips. U. S. 2,324,643, July 20, 1943 (Nov. 15, 1940).

Device for molding objects having a raised pattern. F. Humphris. Belg. 430,340, Oct. 31, 1938. M.Ho.

Facing brick. Ceralux Holdings Soc. Anon. Belg. 428,683, July 30, 1938.—The brick are grooved in such a manner that when two brick are superimposed they fit so well that mortar is superfluous. M.Ho.

Facing or paving brick. D. F. Maufroid. Belg. 429,273, Aug. 31, 1938.—The brick is composed of plastic matter of reticular or porous structure, e.g., clays, and one or more layers of waterproof facing having a sandstone base. M.Ho.

Hollow brick for chimney stacks. N. V. Dakpannenen Kleiwaren-Industrie "De Valk" v/h J. Meuwissen. Belg. 432,915, March 31, 1939. M.Ho.

Manufacturing brick, tile, and other molded objects. F. Humphris. Belg. 430,342, Oct. 31, 1938.—The mix is heated in a hydroextractor at a high temperature and ground. It is then placed in hot molds and compressed at high pressures. M.Ho.

Molding of building blocks and brick. F. Humphris. Belg. 430,301, Oct. 31, 1938.—One side of the brick contains cavities of which some appear in cross section as "D" and others as elongated "O" with flattened sides. The other side of the brick is grooved in a pattern resembling latticework. M.Ho.

New structural material. A. Mampaey. Belg. 432,976, March 31, 1939.—A building brick is made of two terracotta plates with cellular concrete between them. The concrete may be replaced by an argillaceous material, and the whole is fired like brick. M.Ho.

Procedure for manufacturing cellular brick. A. Mampaey. Belg. 431,527, Jan. 31, 1939; addition to Belg. 428,340.—A casein emulsion is added to water, and then is added the clay which has been previously finely subdivided either by stirring it in water or by drying and grinding it. M.Ho.

Structural brick. Rhombrix, Ltd. Belg. 430,598, Nov. 30, 1938.—The dimensions of the rhomboid brick are $(2S + B) = L$, where S designates the length of the short face of the brick, L is the long face, and B is the thickness of the binder between two brick within the brickwork. M.Ho.

Refractories

Activated alumina. V. Aleixandre. *Ion* (Madrid); abstracted in *Chem. Trade Jour.*, **111** [2892] 358 (1942).—The method given in Ger. Pat. 561,713 (I. G. Farbenindustrie A.-G.) for producing activated alumina is recommended. L.R.B.

Casting-pit refractories as source of nonmetallic inclusions in steel. J. R. Rait. *Trans. Brit. Ceram. Soc.*, **42** [4] 57–94 (1943).—Small alloy steel forgings made from 11-in. ingots uphill cast through fire-clay refractories containing 59% silica had low transverse elongations; the

elongations were satisfactory, however, when steel manufactured under identical conditions but uphill cast through aluminous fire-clay refractories was used. The manganese of the liquid steel reduced the free silica, particularly the quartz of the refractory, to produce MnO and Si in an endeavor to reach equilibrium, as the Mn/Si ratio of the steel is greater than the equilibrium value. The MnO thus formed fluxed the refractory to form a liquid manganese aluminosilicate slag. The amount of slag formed on the more siliceous refractories was much greater than that on the aluminous refractories (38% Al_2O_3); this difference in attack is attributed to the large quartz content of the former type and the low content or absence of quartz in the latter. The manganese aluminosilicate slag is washed off the runner brick and carried into the ingots. In the case of the small 11-in. ingots, freezing is sufficiently rapid to trap some of this slag. A greater amount of this slag is introduced and retained in the ingots from the more siliceous refractories than from the aluminous refractories. During forging, these manganese aluminosilicates are plastic and are deformed into stringers. In the case of forgings made from the steel poured through the siliceous refractories, the amount of stringers is sufficient to lower the transverse elongation. The compositions and amounts of slag formed on a given type of refractory by various steels with similar carbon, manganese, and silicon contents are similar; hence it may be concluded that the other alloying constituents have little influence on this reaction. The compositions of the manganese aluminosilicate slags formed on the uphill refractories by the action of various steels with similar carbon, manganese, and silicon contents fall within a small area in the MnO–SiO_2–Al_2O_3 ternary diagram. The line from MnO through the composition of the slag intersects the Al_2O_3–SiO_2 side of the diagram at the approximate composition of the firebrick from which it was derived. The composition of the slaggy inclusions is controlled by the carbon, manganese, and silicon contents of the steel and the composition of the refractories. The crystallization paths of the slags can be obtained from the ternary diagram MnO–SiO_2–Al_2O_3. The majority of the slags from the uphill refractories fall in the mullite field, and a few fall in the corundum field. The inclusions from the tundishes are in the spessartite field. Manganese aluminosilicate inclusions in steel are derived from uphill refractories and tundish linings. These manganese aluminosilicates also occur as scums on ingot surfaces. The constitution and properties of the refractories are extremely important. The manganese attack is greatly reduced when quartz is absent. In various steelworks it has been found that fire-clay nozzles which have been boiled in tar have an increased resistance to wear. This is possibly due to the deposition of free carbon in the pores which decreases the manganese reduction of silica; the evaporation of the volatile fractions of the tar tends to maintain the nozzle at a lower temperature. R.A.H.

Developments in steel-plant refractories. C. A. Brashares. *Iron & Steel Engr.*, **20** [2] 48–52 (1943); abstracted in *Ind. Heating*, **9** [10] 1363–66 (1942).—Superduty silica brick withstand operating temperatures about 85° higher than those of high quality silica brick; their porosity is slightly less but the resulting increase in weight does not complicate the design of the supporting steel members. Superduty fire-clay brick have proved their value in soaking pits and in resisting the effects of flame impingement. High-alumina brick with corundum added are extremely resistant to the chemical action of basic fluxes; they also withstand loads at high temperature ranges. B.L. & M.Ha.

Drying processes with direct heat. D. D. Beach. Presented at Industrial and Commercial Gas Conference, Pittsburgh; abstracted in *Gas World* [Ind. Gas Supp.], **15** [12] 13–14 (1942); *Ceram. Age*, **40** [6] 176–77 (1942). The principles of drying, the many products and industries utilizing drying, and kaolin drying in Georgia are discussed. In 1741, kaolin was dried by the sun and the wind. More recently, natural gas has replaced coal heating. Rotary driers reduce the water content from 20–30% to 5–8%. Tunnel driers contain steam coils for heating the air, but they have been replaced by hot-air heaters. Some clay is dried on cords wrapped around internally heated drums. The cords are dipped in slip, and, as the clay dries, they flex and cast off the clay onto a conveyer. At Proctor & Schwartz, Inc., the clay is extruded like macaroni into a bed 3 to 4 in. deep carried forward on wire mesh, up through which hot air passes. In the spray drying of clay slip, a direct gas-fired air heater is used as well as stack gases. A process for obtaining a special quality of clay mixes superheated steam with pulverized clay.

L.R.B.

Forms and uses of graphite. Bernard H. Porter. *Can. Chem. & Process Inds.*, **27** [3] 36–37 (1943). B.L.

Indian kyanite and possible domestic replacements. H. Wilson. Presented at meeting of American Ceramic Society, Cincinnati, April, 1942; abstracted in *Ind. Heating*, **9** [9] 1208–10 (1942); see "Substitution . . .," p. 156. M.Ha.

Magnesium from dolomite. Anon. *Chem. & Ind.*, **62** [17] 156–57 (1943).—The extraction of magnesium from Canadian dolomite is briefly outlined. Dolomite is ground, mixed with ferrosilicon, and fired in a large oven. The resulting briquettes are taken in canisters by overhead conveyers to the reduction furnaces. Specific details of this process are included. R.H.B.

Manufacture of refractory materials containing silicic acid and alumina. L. Belladen, G. Casetti, and L. Ferro. *Metallurgia Ital.*, **33,** 429–31 (1941); abstracted in *Chem. Zentr.*, **1942, II** [6] 702.—The stability to pressure at high temperatures of refractory materials containing SiO_2 and Al_2O_3 is determined primarily by the firing temperature in addition to the choice of raw materials. The grain composition of the grog and the manufacturing process can also affect the temperature of softening; it is probably a question mainly of the action on the density of packing of the grog grains. M.V.C.

Refractories from western fire clays. W. G. Worcester. *Jour. Can. Ceram. Soc.*, **12,** 13–20 (1943).—W. describes the production of refractories by the Dominion Fire Brick and Clay Products, Ltd., at Claybank, Sask., under the following headings: (1) stripping, (2) winning, loading, and transporting, (3) blending, (4) grog, (5) grinding, (6) elevating and screening, (7) molding by dry press, (8) molding by auger machine, (9) molding by hand, (10) drying, (11) setting and firing, (12) unloading and sorting, (13) sizing and grinding, (14) special products, (15) power and lighting, and (16) research work. Illustrated. See "Industrial . . .," *Ceram. Abs.*, **21** [9] 190 (1942).

G.A.K.

Repairing joints in furnace masonry. H. Kalpers. *Feuerungstechnik*, **30,** 36–37 (1942); abstracted in *Chem. Zentr.*, **1942, II** [6] 702.—K. describes the repairing of defective refractory masonry with grog ramming mixes and a coating 1 cm. thick which can be applied with a compressed air spraying machine. The surfaces to be covered must be thoroughly cleaned beforehand, and all loosely adhering material and slag incrustation must be completely removed. During firing, these mixes fuse together into a solid grog block. M.V.C.

Russian blast-furnace design changed. Anon. *Foundry Trade Jour.*; abstracted in *Iron Age*, **148** [11] 62 (1941).—At the Voroshilov works, the volume of a blast furnace was increased by reducing the thickness of the walls of the stack and the bosh. For the first time in such a large furnace, a plate 0.78 in. thick, linked to the outer jacket, was placed over the brickwork. The space between the old brickwork and the plate was filled with concrete. On the base plate to a depth of 22.6 in., a hot mixture was rammed consisting of the following ingredients in parts by volume: coke 6, chromite 1, magnesite 3, graphite 2, fire-clay flour 2, dehydrated tar 3. On this base 5 layers of refractory brick were raised to a total depth of 67.9 in.

E.H.McC.

Saggers for high temperatures and heavy loads. J. G. *Keram. Rundschau*, **49,** 38–39 (1941); abstracted in *Chem. Zentr.*, **1941, I,** 2301.—The sagger mix is suitable for present furnace systems; more attention must be paid to

stability in circular kilns and to resistance to temperature change in tunnel kilns. The composition of a sagger body for high temperatures and heavy loads is the most important factor for mechanical stability and minimum shrinkage. The necessary stability to temperature change is obtained by the correct choice of thinning agent, i.e., a suitable grog. Careful attention must be given to the choice of suitable raw materials and also to their preparation. Machines for grinding, screening, mixing, and pugging are described. Pressed saggers last longer than molded ones. If the sagger is fired at a temperature higher than that to which it will be subjected in use, it will last longer. M.V.C.

Substitution of topaz, domestic kyanite, and synthetic mullite corundum for India kyanite: I, Kyanite and other high-grade refractories. T. N. McVay and Hewitt Wilson. *Jour. Amer. Ceram. Soc.*, **26** [8] 252–57 (1943). **II, Effect of heat on kyanite and topaz.** *Ibid.*, pp. 257–61. **III, Load resistance of refractories at elevated temperatures.** *Ibid.*, pp. 261–66.—7 figures, 28 references. See "Indian . . .," p. 155.

PATENTS

Aluminates. I. G. Farbenindustrie A.-G. Belg. 428,996, Aug. 31, 1938.—Aluminous minerals are reduced stepwise at temperatures up to 1300°, avoiding fritting. Most of the reduction is effected at temperatures below 1000°, using gaseous reducing agents in the presence of water vapor and/or CO_2. M.Ho.

Bonded silicon carbide refractory. J. P. Swentzel (Carborundum Co.). U. S. 2,324,119, July 13, 1943 (Sept. 25, 1940).—A bonded silicon carbide refractory article comprising 0.5 to 10% of a barium salt distributed uniformly throughout the body of the article.

Carbon-containing refractory brick. Dortmund-Hoerder Hüttenverein A.-G. Belg. 428,674, July 30, 1938.—The tailings of coal washing are used as a source of carbon. M.Ho.

Crucible furnace. C. E. Milligan (Electro Refractories & Alloys Corp.). U. S. 2,324,864, July 20, 1943 (Oct. 11, 1941).

High-alumina refractory. A. E. Fitzgerald (General Refractories Co.). U. S. 2,325,181, July 27, 1943 (Oct. 23, 1940).—The process of producing a high-alumina refractory which comprises calcining a raw mineral which is essentially hydrated alumina by itself without fusion, mixing the calcined alumina mineral with 7 to 30% of uncalcined clay containing 60 to 75% silica, molding the mix, firing the mix at a temperature above pyrometric cone 10, and stopping the firing while the refractory is still capable of further expansion on reheating.

Improvement in the manufacture of magnesia binders. P. J. Rouzaud. Belg. 430,141, Oct. 31, 1938.—Th sulfate is added to the binder. M.Ho.

Procedure for obtaining pure magnesium from its minerals. Seri Holding Soc. Anon. Belg. 429,916, Oct. 31, 1938.—Using HF, Mg is extracted from its minerals as a fluorite. The HF is reclaimed in a subsequent operation for reuse. The fluorite is treated with a tetravalent reducing agent at a temperature at which the Mg distills over in an oxidizing atmosphere. The Mg vapors are condensed. M.Ho.

Production of magnesium oxide from sea-water brines and like liquors containing convertible magnesium. Ocean Salts (Products), Ltd., and W. E. Prytherch. Brit. 553,731, June 17, 1943 (Dec. 20, 1940).

Refractory composition. Eugene Wainer (Titanium Alloy Mfg. Co.). U. S. 2,323,951, July 13, 1943 (Sept. 27, 1941).—A dry refractory composition containing a major portion of zircon and a minor portion of an acid phosphate taken from the group consisting of ammonium and inorganic and organic derivatives of ammonium.

Refractory mass for siderothermal furnaces operating on basic charges. G. B. Crespi. Belg. 429,749, Sept. 30, 1938.—The refractory mass consists essentially of calcined dolomite ground to small particle size. M.Ho.

Refractory material. V. M. Goldschmidt. Belg. 429,914, Oct. 31, 1938.—A ceramic refractory material is mixed with a filler consisting of Mg orthosilicate or a material rich in Mg orthosilicate, such as olivine poor in Fe. M.Ho.

Refractory and method of producing. H. M. Schleicher and W. E. Iverson (Scovill Mfg. Co. and U. S. Metal Refining Co.). U. S. 2,325,553, July 27, 1943 (April 14, 1941).—Method of providing a zirconium compound refractory penetration into a puffed clay brick which comprises applying orthophosphoric acid (U. S. syrupy 85%) to a surface of the brick to be treated, introducing into the surface interstices a mixture comprising a zirconium compound, phosphoric acid as a bonding agent, and water, the mixture being so constituted and prepared as to have a paint-like consistency, then drying, baking, and firing the brick.

Terra Cotta

Clay septic tank. Anon. *Architectural Forum*, **78** [5] 198 (1943).—A new vitrified clay tank for sanitary disposal of sewage and household wastes is described. The tank is manufactured by the Robinson Clay Product Co., Akron, Ohio. M.E.P.

Glazes and painting on stove tile. Anon. *Keram. Rundschau*, **49** [5] 46–48; [6] 60–61; [7] 70–71; [8] 78–80 (1941); abstracted in *Chem. Zentr.*, **1941, I,** 2574.—A review is given with information on tested batches. M.V.C.

PATENT

Sinks, lavatory basins, etc. A. G. Shaw and Shaw's Glazed Brick Co., Ltd. Brit. 553,919, June 23, 1943 (Dec. 18, 1941).

Whiteware

Bulgarian raw materials in the porcelain industry. I. D. Semenoff. *Khim. i Industriya*, **20,** 124–28 (1941); abstracted in *Chem. Zentr.*, **1942, II** [6] 702.—The analyses of different deposits of kaolin, feldspar, and clay are given, and the situation of the Bulgarian porcelain industry is discussed. See *Ceram. Abs.*, **21** [10] 217 (1942). M.V.C.

Casting slip control. Arthur S. Watts. *Bull. Amer. Ceram. Soc.*, **22** [8] 298 (1943).

Zinc white in ceramic bodies. A. Foulon. *Pharm. Zentralhalle*, **83,** 289–91 (1942); abstracted in *Chem. Zentr.*, **1942, II** [9] 1047.—Zinc white is important as a flux and as a refining agent in the manufacture of ceramic glazes as it can replace boric acid. Zinc white is superior to technical zinc oxide because it is always produced with uniform grain size and chemical purity, and troublesome secondary reactions produced by impurities do not occur. See *Ceram. Abs.*, **20** [2] 43 (1941). M.V.C.

SEPARATE PUBLICATION

Study of Glaze Stresses. William C. Bell. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 114, 28 pp. (May, 1943).—In the first part B. studies glaze-fit test methods and the effect of glaze stress on crazing. Conclusions are as follows: (1) The thicker the glaze film, the greater is the warping. (2) High compression in the glaze helps prevent crazing. (3) Various glaze-fit tests give comparable values. (4) The ring test is satisfactory for the qualitative measurement of glaze stress. (5) The flat-plate test is good for two-fire but not for one-fire glazes. (6) The tuning-fork test is satisfactory as a laboratory test. The second part correlates glaze stresses and

physical properties of glazed vitreous bodies. Conclusions are as follows: (1) To correlate glaze and body expansions with glaze stresses, the glaze expansion should be taken to its softening point. (2) Individual measurements of glaze-body expansions are not always sufficient to establish glaze stress. (3) Both tuning-fork and ring tests may be used in correlating glaze stress with the effect of the glaze on the body properties. (4) There is a definite correlation between glaze stress, flexural strength, and thermal endurance of a glazed specimen. (5) Because of the variation in glaze-stress condition with thermal treatment, it is always necessary to use a standard body and glaze with the same thermal history for comparison. W.D.F.

PATENTS

Ceramic products resistant to temperature changes. ROBERT BOSCH G.M.B.H. Belg. 433,879, May 31, 1939.—The predominating component of the body is twice-fused alumina. The second fusion is done in an electric furnace at a temperature exceeding 2000°. M.Ho.

Removable covers for casseroles and other ovenware. B. G. STAGG. Brit. 554,146, July 7, 1943 (Feb. 13, 1942).

Spark plug. J. A. D'ELIA. U. S. 2,324,616, July 20, 1943 (Nov. 13, 1941).

Thimble-equipped insulator. R. W. BARNITZ (Porcelain Products, Inc.). U. S. 2,323,967, July 13, 1943 (Sept. 12, 1940).

Vibrator for molding tubes and other hollow or tubular objects. F. MOSER. Belg. 430,420, Oct. 31, 1938. M.Ho.

Equipment and Apparatus

Analysis of constant-pressure filtration data. DAVID J. PORTER. *Ind. Eng. Chem., Anal. Ed.*, **15** [4] 269 (1943).—Illustrated. F.G.H.

Apparatus for making X-ray powder photographs at controlled elevated temperatures. M. J. BUERGER, NEWTON W. BUERGER, AND FRANK G. CHESLEY. *Amer. Mineralogist*, **28**, 285–302 (1943).—The camera devised has two improvements: (1) the film holder is removable without disturbing the specimen or its position in the furnace; (2) it is insulated against radiation losses rather than conduction losses. The furnace has negligible heat capacity, therefore, and the temperature of the specimen may be varied rapidly. The furnace has been used up to 600 °C. and is suited to higher temperatures. The apparatus is especially suitable for phase-rule investigations. W.D.F.

Apparatus for the measurement of thermal expansion at temperatures up to 100 C. H. H. MACEY. *Jour. Sci. Instruments*, **20** [3] 48–49 (1943).—The thermal expansion of fire-clay materials is small at temperatures up to 100 °C., and high sensitivity is required in any apparatus designed for its measurement. M. describes an apparatus for the measurement of thermal expansion involving a compact but sensitive optical lever system. G.A.K.

Discussion of "Distribution of a liquid in a porous space." ANON. *Chem. Age* [London], **48** [1238] 313 (1943).—A paper by R. K. Schofield (*Jour. Inst. Phys.*) is discussed, and its value in the drying of ceramic products is pointed out. The paper, however, needs interpretation. During absorption the larger pores are filled by natural flow, and the smaller ones by capillary attraction. During draining the smaller pore spaces remain full, only the larger ones being partly emptied. On drying, the larger pores lose their water first, and the smaller ones much later, owing to the resistance to flow caused by capillary bottlenecks which join larger pores. A.B.S.

Drying of solids by through circulation. W. R. MARSHALL, JR., AND O. A. HOUGEN. *Trans. Amer. Inst. Chem. Engrs.*, **38** [1] 91–121 (1942).—Through-circulation drying is characterized by the subdivision of the material into small particles to form a permeable bed through which heated air is blown. Substances which are not in a suitable state must be preformed by grinding, extrusion, briquetting, etc. It has the following advantages over tray or cross-circulation drying: rapidity, a continuous process, less labor, less exposure of the material to high temperatures, and a more uniform product, usually in a form suitable for subsequent processing. The purposes of the experiments were (1) to compare the drying characteristics of different materials (asbestos, calcium carbonate, sawdust, coke, etc.); (2) to study the particular features of this method in comparison with tray drying; and (3) to investigate the effect of air velocity on the drying rate. Commercial equipment was used throughout. The drying-time curves (except those for soap) have the same general shape, all showing a linear change in moisture content with time at first, followed by a gradually decreasing curvature. The curves are similar to those for tray drying. The mechanism of material transfer in through-circulation drying in the constant-rate period is analogous to the operations of humidification, desorption, and similar problems of heat and mass transfer, and thus an equation can be written for the constant-rate period. The rate of drying decreases with an increase in the size of the particle, while in tray drying this has little effect in the constant-rate period. The shape of the time-moisture curve below the constant-rate period is expressed by an exponential equation, i.e., the rate of drying is proportional to the free-moisture content. A large amount of uncorrelated data on industrial through-circulation drying tests was obtained, including time-moisture contents, air velocities, static pressure drops, and the states of subdivision of the material. A third curve, unobtainable in tray drying, was termed a shrinkage curve and was determined by the variation in pressure drop through the bed during drying. 8 illustrations and 19 graphs. E.D.M.

Gelatin-coated slides for refractive-index mounts. H. W. FAIRBAIRN. *Amer. Mineralogist*, **28**, 396–97 (1943).—A gelatin-coated slide is used by putting on a drop of water to soften the gelatin and shaking it off after a few seconds. Well-dried mineral grains are scattered on the soft spot, and the slide is put in a cool place to harden. A drop of refractive-index oil and a cover glass are then applied. After examination, the cover glass is removed, the oil is washed off carefully with a suitable solvent, and another oil can be applied. This method is economical of material and allows re-examination of grains in the most favorable orientation. W.D.F.

Heat-transfer problems solved by electrical analyzer. ANON. *Product Eng.*, **14** [7] 442–46 (1943).—An electrically operated apparatus which makes it possible to solve problems of heat flow and heat transfer (by conduction, convection, and radiation) is described; the quantities in the heat formulas are replaced by electrical quantities, as both are analogous. A few examples are given to illustrate how the method can be applied to determine temperature changes in time in a body, heat quantities stored or lost, or the best material for a definite purpose. The electrical analyzer can also be applied to problems of chemical diffusion and to flow of fluids or mass transfer. M.Ha.

Improved meter for measurement of gas-flow rates. W. G. APPLEBY AND W. H. AVERY. *Ind. Eng. Chem., Anal. Ed.*, **15** [5] 349–50 (1943).—Details of construction are described and illustrated. F.G.H.

Instrumentation in the ceramic industry and the priority problem. T. A. COHEN. Presented at meeting of American Ceramic Society, Cincinnati, April, 1942; abstracted in *Ind. Heating*, **9** [7] 905–906, 966 (1942).—The development, application, and production of new products and replacements of safety devices and apparatus in the ceramic industry under the present conditions of shortage of vital materials are discussed, and a classification of instruments is given with a list of substitute materials for proper priority rating. See "Maintenance . . .," *Ceram. Abs.*, **22** [6] 104 (1943). M.Ha.

Method of measuring the thermal conductivity of rock cores. J. B. HERSEY. *Jour. Applied Physics*, **12**, 498–501 (June, 1941); *Science Abs.–A*, **45** [530] 52 (1942).—A method of measuring the thermal conductivity of long rock-core samples is described. It is an adaptation of Bidwell's method of measuring the thermal conductivity of metals. The core is packed in Sil-O-Cel in a cylindrical container. Heat is supplied by a flat electric heater on one end of the core sample, and measurements of temperature are made along the core and at several radial distances in the insulator. Isothermal surfaces in the insulator are determined and found to be conical surfaces within several centimeters of the core. These are parallel for some distance along the core. Using this fact, the conductivity of the core is computed relative to that of the Sil-O-Cel. A value of 5.92×10^{-3} cal. per cm. ° sec. was obtained for a sample of norite and 2.59×10^{-3} for a Pyrex brand rod at room temperature. H.K.R.

Modification of Cenco spectrophotometer permitting measurements of reflection and fluorescence spectra. HERBERT J. DUTTON AND GLEN F. BAILEY. *Ind. Eng. Chem., Anal. Ed.*, **15** [4] 275–77 (1943).—Methods for the determination of the color of opaque objects fall, essentially, into three categories: (1) those employing color charts or standards for comparison, (2) those employing colorimeters and comparators which synthesize colors similar to the colored samples, and (3) those employing spectrophotometers. Only the spectrophotometers have the advantage of resolving color into fundamental physical units. The investigator who does not have available a reflection spectrophotometer, but who does have the Cenco type transmission spectrophotometer, may readily modify that instrument to permit the measurement of reflection spectra. Fluorescence spectra may also be measured with this instrument through the use of a nearly identical optical system. The authors describe the modifications required which permit the measurement of reflection and fluorescence spectra with moderate resolution. Illustrated. F.G.H.

***New interference instrument for examination of the shape of areas and plates and for use as interference comparator.** R. LANDWEHR. *Z. Instrumentenk.*, **62** [3] 73–84 (1942).—L. describes a new interferometer built especially to measure, without changing its arrangement, planeness, curvature, and surface structure and the parallelism of and angle between parallel plates. M.HA.

New method for the characterization of the surface quality of materials. J. HEYES AND W. LUEG. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf*, **24** [3] 31–39 (1942).—A new method is described which can be used with both highly polished and very rough surfaces, plane or curved, and which can be standardized and used in routine measurements in the shop. It consists in determining the light thrown into the microscope objective lens by the surface, first under bright-field illumination and then under dark-field illumination; the quotient of the two is a measure of the quality of the surface, and the reciprocal value is a measure of the roughness. The method is well suited for showing the surface differences between successive stages of surface treatment. M.HA.

Photoelectric absorptiometer, the polarograph, and the spectrograph: critical review. H. W. WHALLEY. *Chem. & Ind.*, **61** [49] 495–97 (1942).—W. reviews the analytical uses of the absorptiometer, the polarograph, and the spectrograph. R.H.B.

Portman universal optical comparator. ANON. *Machinery* [N.Y.], **49** [7] 189 (1943).—The optical comparator has a range of magnification from 10× to 100×. The instrument has application in machine-tool departments where the inspection of gear teeth is required. It is manufactured by the Portman Machine Tool Co. R.H.B.

Quartz pebbles for ball-mill grinding in Saskatchewan. ANON. *Eng. Mining Jour.*, **144** [4] 71 (1943).—A practically inexhaustible supply of quartzite ball-mill pebbles exists in the Swift Current, Eastend, and Cadillac areas in southwestern Saskatchewan. They are mixed with pebbles of other rocks of the same shape and often the same color and must be separated by hand-sorting. W.D.F.

Reduce capital outlay and operating cost with welded-base jaw crushers. RALPH W. HEER AND WILLIAM A. ECKLEY. *Concrete, Cement Mill Ed.*, **51**, 171–73 (1943).—By using a box section for a base and welding it, it is possible to cut the weight 15 to 30% without a decrease in strength and to cut the total cost from 10 to 30%. Further savings could be made by using welding jigs. Another advantage is easier assembly, as holes can be more accurately located. W.D.F.

Standard grindability tests and calculations. FRED C. BOND AND WALTER L. MAXSON. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1579; *Mining Tech.*, **7** [2] 11 pp. (1943).—Standard grindability tests were made on a large number of materials in a laboratory ball mill and a laboratory rod mill. The tests were conducted at minus 28-mesh to minus 200-mesh on the ball mill and at minus 3-mesh to minus 65-mesh on the rod mill, and the results are expressed as net grams undersize per revolution. The tables cover 8 pp. The materials tested comprised many ores, metallurgical products, rocks, nonmetallic minerals, ceramic products, Portland cement, etc. W.D.F.

Welding electrodes. JOHN W. MILLER. *Wire & Wire Prod.*, **18** [5] 279–81 (1943).—Coatings consist of (1) arc-stabilizing compounds, (2) slag-forming compounds, (3) deoxidizers, and (4) binding material. Compounds included and their uses are as follows: iron oxide, red or magnetic (2), titanium dioxide (1 and 2), magnesium and aluminum silicates (2), lime (1 and 2), ferromanganese and cellulose (3), and sodium silicate (4). B.L.

SEPARATE PUBLICATION

Bibliography of the Literature Relating to Constitutional Diagrams of Alloys. J. L. HAUGHTON, compiler. Institute of Metals Monograph and Report Series, No. 2. Institute of Metals, London, 1942. iv + 163 pp. Price, limp cloth, 3s 6d, post free.—This Bibliography contains over 5000 references to papers dealing with the constitution of binary, ternary, and higher alloy systems, both ferrous and nonferrous. References have been included not only to papers of a purely constitutional character but also to many X-ray and physical-property studies of alloys which have some bearing on the constitution. To furnish some guide to the references, which in a few systems exceed 100, asterisks have been placed against those in the originals of which a new equilibrium diagram, or portion of one, is to be found. It is intended that the Bibliography shall be used in conjunction with the abstracts published by the Institute since its foundation, first in the *Journal of the Institute of Metals* and later in *Metallurgical Abstracts* (Series II); for convenience, therefore, references have been included to these abstracts, whenever such exist. The Bibliography is thoroughly up to date and contains references to all papers seen up to the time of going to press. It should prove invaluable to all research workers in metallurgy, works' metallurgists, and others interested in the constitution of metallic alloys.

PATENTS

Apparatus for decorating pottery ware. W. J. MILLER. U. S. 2,324,410, July 13, 1943 (March 29, 1935; June 6, 1941).

Apparatus for decorating pottery ware, glassware, etc. W. J. MILLER, L. P. REESE, AND G. J. CRONINGER. U. S. 2,324,411, July 13, 1943 (March 11, 1941).

Brick press. A. STASSIN. Belg. 433,929, May 31, 1939. M.HO.

Brick-press liner. G. E. SEIL (E. J. Lavino & Co.). U. S. 2,324,884, July 20, 1943 (March 11, 1942).

Drawplate for the manufacture of ceramic products. J. N. OSINALDE. Belg. 431,202, Dec. 31, 1938.—The covering paste, engobe, enamel, or glaze is applied to the body while it goes through the drawplate. The paste, etc., is injected into the drawplate at high pressure. M.HO.

* Obtained from microfilm.

Equipment for working hard materials such as stone, marble, etc. Soc. Anon. Le Progres Industriel, Namurois. Belg. 431,766, Jan. 31, 1939. M.Ho.

Ferrous alloy thermocouple element. D. I. Finch (Leeds & Northrup Co.). U. S. 2,325,759, Aug. 3, 1943 (Dec. 28, 1939).—A thermocouple element consisting of a ferrous alloy having a composition comprising, among its nonferrous components, manganese, nickel, and copper in substantially the percentages by weight of 0.22 to 0.24, 0.04 to 0.05, and 0.115 to 0.125, respectively.

Mechanism for controlling the filling of molds in molding machines and ejecting the molded product. F. Humphris. Belg. 430,341, Oct. 31, 1938. M.Ho.

Method of and apparatus for dewatering comminuted materials. F. K. Knudsen (Porcelain Enamel & Mfg. Co.). U. S. 2,323,920, July 13, 1943 (Sept. 30, 1939).

Mold made on an animal-glue base. C. Le Bos d'Espinoy. Belg. 432,398, March 31, 1939.—A white limestone is powdered and mixed in a heated state with gelatin or another animal glue. If desired, this mass can be colored. M.Ho.

Molding machine for hollow bodies made of clay, stoneware, etc. Ateliers Heuze, Malevez & Simon Réunis Soc. Anon. Belg. 432,673, March 31, 1939.—The apparatus is primarily intended for making clay and stoneware pipes. It supports the roughly shaped body, cuts it to size, shapes the male and female ends of it, and finishes it. M.Ho.

Procedure and apparatus for the preparation of granular material to be used in cement. Fried. Krupp Grusonwerk A.-G. Belg. 432,555, March 31, 1939.—The granular crude is agglomerated with water or another binder. The agglomerated grains are then placed in a roller grate where they are rolled and simultaneously classified. The oversize material is ground and added to the rest. M.Ho.

Procedure and apparatus for working clays. L. Gerecht. Belg. 429,768, Sept. 30, 1938.—Wet clay is centrifuged in the apparatus described, thus eliminating any contaminating substances and at the same time disintegrating the clay, wetting it, and homogenizing it. M.Ho.

Kilns, Furnaces, Fuels, and Combustion

Ceramic chemistry—firing methods and pyrometry. A. B. Hollowood. *Chem. Age* [London], **48** [1229] 85 (1943); reprinted in *Ceram. Age*, **42** [1] 12–13 (1943); see "Firing . . .," *Ceram. Abs.*, **22** [1] 16 (1943). A.B.S. & F.G.H.

Comparison of industrial fuel gases on the basis of their properties relating to the technique of firing. H. Schwiedessen. *Arch. Eisenhüttenwesen*, **16** [5] 167–72 (1942).—S. discusses all conditions to be considered in the selection of a gaseous fuel and points out that heating value and price per unit cannot alone determine the selection but that firing efficiency, specific heat of the gases, ratio of waste gases to heating value, quality of products, operating costs, and heat losses play important parts. These considerations hold good for all important fuel gases such as coke-oven, producer, and blast-furnace gas. M.Ha.

Consumption of coal in a periodic kiln. D. L. Wilson. *Claycraft*, **16** [4] 119–24; [5] 161–65; [6] 207–12; [7] 257–60 (1943).—W. takes as a basis for discussion an average kiln, as far as the refractories industry is concerned, analyzes it, and shows where possible improvements could be made which would result in a reduction in fuel and permit different classes of coal to be burned. The purpose is to transfer the heat potential from a minimum amount of coal to a given quantity of ware. The transferring medium is the main draft which must satisfy the following conditions: (*a*) economic consumption of coal, (*b*) transfer of heat to the ware, and (*c*) easy control. A kiln designed to have the level of the firebox and the exit flue equal has the following advantages: (1) additional control at all stages, (2) a reduction in the air necessary to complete combustion of the coal, (3) quicker attainment of good draft conditions from cold and quicker water-smoking, and (4) maximum heating conditions in any part of the kiln. These points lead to economy in fuel and a shorter kiln cycle. W. also discusses the effect of leaks in the crown and the flue and their remedies. Reasons for loss of draft are excessive velocity, friction, obstruction and sudden changes of direction in the flue system, or sudden changes in cross-sectional area. The larger the diameter of the flue, the smaller is the loss due to friction; flues should therefore be cleaned out regularly. An economical sized flue should give a gas speed of about 400 ft. per min. Although there are a great many variations, the fire hole has three functions: (*a*) to heat the ware to the required degree, (*b*) to create the draft necessary to maintain even distribution of heat, and (*c*) to burn the type of fuel being supplied. A firebox designed to burn one type of coal economically will result in disastrous waste of fuel if used with another type of coal. W. describes several types of fireboxes designed for various types of coal. Mildly clinkering coals require sloped bars to give a slightly longer fuel bed than horizontal bars. Heavily clinkering coal is best burned in a firebox with a stepped grate to keep the clinker toward the front of the ashpit and facilitate its removal. Other fireboxes are also described, one for use with coal which tends to crumble in the hot coking zone and fall through the firebars unburned, a firebox successful with a small coal about $^1/_2$ in. in size, and one for coal 2 in. in size. A new kiln should be insulated thoroughly, flues, bottom, walls, and crown, with insulation that is strong physically and placed as near the hot face as possible. Insulation must be protected from the outside by a dampproof course on roof, walls, and bottom and around the flues. Illustrated. G.A.K.

European electric tunnel kilns for high-temperature ceramic firing. H. R. Dickey. *Jour. Can. Ceram. Soc.*, **12**, 3–8 (1943).—D. describes electric tunnel-kiln installations in Italy and Switzerland that were inspected by him in 1940. Lack of oil and suitable coal for fuel has stimulated the development of electric tunnel kilns in Europe. The kilns are of conventional design, and the heating elements are of the silicon carbide type, placed vertically on both sides of the high-temperature zone. The majority of the kilns are of the double-tunnel counterflow type. Provision is made for the installation of additional heating elements and for moving or changing the grouping of elements. The top and bottom terminals of the elements are water cooled. Electrical control is simple. Temperature is regulated by automatic adjustment of the voltage of each group of elements. Kilns are normally operated under a slight positive pressure. Each kiln is provided with a special test car having four or six thermocouples, by means of which temperature diagrams are obtained. Illustrated. G.A.K.

Heat capacities of hydrocarbon gases. Daniel R. Stull and F. Drew Mayfield. *Ind. Eng. Chem.*, **35** [6] 639–45 (1943).—The method of calculating gaseous heat capacities from spectroscopic data, as developed by Bennewitz and Rossner and modified by Dobratz, has been extended to a wider temperature range. By reassignment of certain frequencies, the method has been brought into closer agreement with literature data on heat capacities; it has also been extended to acetylene derivatives. A table of solutions to the Einstein function for one degree of freedom is included. A table of bonding frequency contributions to the molar heat capacity for temperatures of 250° to 1500°K. is presented. The calculated heat capacities of 29 hydrocarbons over the temperature range 250° to 1500°K. are compared with previously published data and show an average difference of ±4%. Illustrated. F.G.H.

Microdetermination of volatile matter in coal and coal products. Martin Neuworth and W. R. Kirner. *Ind. Eng. Chem., Anal. Ed.*, **15** [5] 359–60 (1943).—A micro-

method is described which has the same reproducibility as the A.S.T.M. macroprocedure but gives somewhat higher results. Carbonization, sample introduction, and sample removal occur under conditions which minimize air oxidation. The method can be applied to samples varying over a wide range of volatile matter without modifying the technique. F.G.H.

PATENTS

Arrangement for firing brick in open air. M. HAUMONT. Belg. 433,736, May 31, 1939; addition to Belg. 431,444 (see "Procedure . . . ," this page). M.Ho.

Electrically heated tunnel kiln for ceramic products. R. GOTTIGNIES AND L. GOTTIGNIES. Belg. 430,018, Oct. 31, 1938.—Within this kiln the ceramic ware proceeds in such manner that in adjacent passages, both in juxtaposition and superposition, the ware moves in opposite directions. M.Ho.

Kiln structure. J. T. ROBSON, E. H. WATKINS, AND E. G. ZIMMERMAN (Ferro Enamel Corp.). U. S. 2,325,572, July 27, 1943 (March 10, 1941).—In a kiln structure, apparatus for withdrawing highly heated gas from a part of the kiln structure comprising a duct disposed within a kiln wall, means for supplying air under pressure to the duct, a refractory nozzle member within the kiln wall and forming an outlet from the duct, a refractory Venturi member within the kiln wall and spaced from but having its inlet end adjacent to the outlet of the nozzle, the kiln wall having a chamber adjacent the space between the outlet from the nozzle and inlet to the Venturi, and means for conducting gas from the part of the kiln to the chamber.

Method and apparatus for forming clay sagger pins. F. B. DEHN (Industrial Ceramic Products, Inc.). Brit. 553,764, June 17, 1943 (Aug. 18, 1941).

Procedure for firing brick in the open in the field. M. HAUMONT. Belg. 431,444, Jan. 31, 1939.—The arrangement of brick is described. M.Ho.

Tunnel kiln. F. J. HELLEBOOGE. Belg. 428,682, July 30, 1938.—The ware is loaded on carts and kept thereon during the firing period. M.Ho.

Geology

"Big" mine produces four nonmetallic minerals. ANON. *Eng. Mining Jour.*, **144** [4] 80 (1943).—The Big mine in Cheshire County, N. H., produces feldspar and mica with quartz and beryl as by-products. The deposits are in an irregular pegmatite trending northeast and dipping southeast. The country rock is a schist with garnet and tourmaline. The pegmatite is zoned distinctly. Next to each wall is a 3- to 5-ft. band of sheet mica with albite-oligoclase and quartz; next is a 10- to 20-ft. zone of biotite, plagioclase, and quartz; the central zone is quartz and graphic granite with microcline-perthite. Beryl occurs in the second zone near quartz veins and also in the central zone. W.D.F.

Bird River chromite deposits, Manitoba. J. D. BATEMAN. *Trans. Can. Inst. Mining & Met.*, **46**, 154–83 (1943).—Several chromite deposits have been found in a district about 80 miles northeast of Winnipeg. They represent segregations of chromite formed during consolidation of the flat-lying Bird River sill in Pre-Cambrian time. The deposits contain both dense and disseminated ores. Small faults are common. The average grade is from 18 to 26% chromic oxide. Tabling increases the grade to 35 to 42%. The chrome-iron ratio is 1.2:1 to 1.5:1. Special processes are required to yield a commercial product, and future development of the ores depends on the commercial feasibility of such treatment. G.M.H.

Canadian talc for use in steatite insulators. H. S. SPENCE, J. G. PHILLIPS, AND W. T. TURRALL. *Bull. Amer. Ceram. Soc.*, **22** [8] 295–98 (1943).

Cordierite: (*A*) Cordierite crystals from a glass furnace; (*B*) Cordierite from Horns Nek, Transvaal. S. J. SHAND. *Amer. Mineralogist*, **28**, 391–95 (1943).—Cordierite crystals grew as a crust on the wall of the glass tank a little distance above the top of the melt. The wall was almost the composition of mullite; the glass was a borosilicate containing magnesium. The temperature may reach 1600°C. Dust from the charge may have caused the reaction. The crystals have the shape of hexagonal prisms, but a thin section shows a complex aggregate of the familiar sector twinning and an irregular intergrowth. Optical properties are negative, $2V = 82°$, $\gamma = 1.5270$, $\alpha = 1.5223$. The chemical analysis shows that the ratio MgO + CaO:Al_2O_3:SiO_2 is almost exactly 2:2:5. A supposed nepheline granophyre from Horns Nek, Transvaal, was re-examined and found to be a cordierite-hypersthene hornstone formed by thermal metamorphism of a siliceous slate; orthoclase and quartz also occur. $2V$ for the cordierite averages 70°. W.D.F.

Crystal structure of gillespite. A. PABST. *Amer. Mineralogist*, **28**, 372–90 (1943).—Gillespite has been studied by various X-ray methods. It is tetragonal, and the unit cell, $a = 7.495$ a.u., $c = 16.050$ a.u., contains $4BaFeSi_4O_{10}$. It has a silicate sheet structure with oxygen atoms in three kinds of positions and unshared corners of SiO_4 tetrahedra on both sides of the sheet. Barium has an 8-fold coordination, and iron a 4-fold coordination. Leaching gillespite removes all the iron and barium; it is still uniaxial negative but with a lower index; however, it is amorphous to X rays. W.D.F.

Effect of type of clay mineral on the uptake of zinc and potassium by barley roots. C. M. ELGABALY, H. JENNY, AND R. OVERSTREET. *Soil Sci.*, **55** [3] 257–63 (1943).—Zinc and potassium ions adsorbed on clay particles are readily utilized. At normal concentrations, more cations are released from bentonite than from kaolinite. All the factors associated with the nature of the colloidal clay are not yet evaluated. N.R.S.

Freezing points of soils and clays. G. B. BODMAN AND P. R. DAY. *Soil Sci.*, **55** [3] 225–45 (1943).—The authors investigated, by means of the freezing-point method, the magnitudes of the free energy of soil water at different water contents and the factors affecting these magnitudes, including texture, dissolved solute, constituent clays, and alteration of structure. Fourteen nonsaline surface soils were used. N.R.S.

Gamagarite, a new vanadium mineral from the Postmasburg manganese deposits. J. E. DE VILLIERS. *Amer. Mineralogist*, **28**, 329–35 (1943).—Gamagarite has been found in the manganese ores of the Postmasburg district, Cape Province. Its composition is $Ba_4(Fe,Mn)_2V_4O_{15}(OH)_2$. It is dark brown with prismatic habit. Other properties are hardness $4\frac{1}{2}$ to 5; specific gravity 4.62; monoclinic and elongated parallel to b. Optical properties are $\alpha = 2.016$, $\beta = 2.040$, $\gamma = 2.130$; $2V = 46°$ to 62°; pleochroic, red-brown to light salmon-buff. W.D.F.

Iridescent garnet from the Adelaide mining district, Nevada. EARL INGERSON AND JULIAN B. BARKSDALE. *Amer. Mineralogist*, **28**, 303–12 (1943).—Garnets from a lime-rich layer in the contact zone of a granodiorite stock ten miles south of Golconda, Nev., show brilliant iridescence both on striated crystal faces and in thin section. Their birefringence is about 0.0025, and they have lamellas that look like polysynthetic twinning parallel to (110) and (111). The iridescence is due to the very fine (111) lamellas. Heating the garnets causes a decrease of birefringence starting at 1060°C. and continuing practically to the melting point just below 1250°C., but the twinning lamellas and iridescence are still visible. W.D.F.

Operating the Grau chrome mine. ARTHUR O. HALL. *Mining Congr. Jour.*, **29** [3] 16–17 (1943).—The Grau mine is 34 miles west of Red Bluff, Calif. Here dunite occurs as a segregation from saxonite; the dunite has been faulted, and serpentinized material is found along faults and joints. The chromite occurs within the dunite. It ranges from sparsely disseminated to massive lenses of pure mineral analyzing 55% Cr_2O_3. The dunite occurs in

lenses dipping flatly into a steep hillside of saxonite. The chromite is being mined by open-pit methods, the ore being sorted out by hand. W.D.F.

Preliminary description of the new mineral partridgeite. J. E. DE VILLIERS. *Amer. Mineralogist*, **28**, 336–38 (1943).—Partridgeite, Mn_2O_3, has been found in the Postmasburg manganese ores, Cape Province. In hand specimen and polished section, it closely resembles sitaparite, $(Mn,Fe)_2O_3$. A mixture of equal parts 50% H_2SO_4 and 10% H_2O_2 strongly etches partridgeite but has no effect on sitaparite. W.D.F.

Rare earths, their history, occurrence, separation, properties, and application. LÉON LORTIE. *Can. Chem. & Process Inds.* (Can. Lab.), **27** [4] 213–16 (1943). B.L.

Raw materials. JOHN R. HOSTETTER. *Bull. Amer. Ceram. Soc.*, **22** [8] 290–92 (1943).

Soil tube for obtaining wet clay cores in an undisturbed structural condition. A. J. STEWART. *Soil Sci.*, **55** [3] 247–51 (1943).—A new soil tube designed especially for obtaining cores from wet clay is described. The cutting head is made of copper and is therefore not suitable for use in gravel soil. The cutting head is made slick by a mercury coating. N.R.S.

Unique occurrence of bobierrite, $Mg_3(PO_4)_2 \cdot 8H_2O$. JOHN W. GRUNER AND C. R. STAUFFER. *Amer. Mineralogist*, **28**, 339–40 (1943).—Bobierrite was found as a thin layer between the outer shell and inner core of a fossil elephant tusk, embedded in what was probably Nebraskan till. This was found one mile southwest of Edgerton, Pipestone County, Minn. It is significant that a magnesium phosphate can develop from the calcium phosphate (apatite) of the ivory tusk. W.D.F.

United Feldspar's pyrophyllite enterprise. ANON. *Eng. Mining Jour.*, **144** [4] 69–71 (1943).—The United Feldspar and Minerals Corp. mines pyrophyllite on Soapstone Mountain, Randolph County, N. C., through its subsidiary, the Carolina Pyrophyllite Co. The mine is an open pit, about 50 x 150 ft. The walls are practically vertical and up to 100 ft. high. There is practically no overburden. The excavation is entirely in pyrophyllite; a streak of sericite is mined separately. The mineral is trucked to the plant, after having been hand-sorted at the mine to remove off-color material. Four grades of rock are delivered into separate bins: (1) standard, (2) No. 24 enamel, (3) off-color, and (4) sericite. These grades are handled separately at the mill. The mineral is crushed in a jaw crusher and ground in a conical mill in closed circuit with a separator. The finished material is shipped in bulk or bagged. The conical mill had been lined with Belgian flints. Minnesota jasper was tried but was too soft. Now Salisbury granite is used. W.D.F.

Western talcs. W. WALLACE ROFF. *Bull. Amer. Ceram. Soc.*, **22** [8] 292–95 (1943).

Zinc mining revived at the Prince. ANON. *Mining Congr. Jour.*, **29** [5] 54–55 (1943).—The Prince mine is two miles south of Pioche, Nev. It had been producing a silver-lead-zinc ore from limestone replacements, and there was considerable oxidized manganese ore. The mine was shut down when the vertical shaft reached 835 ft. and encountered considerable water. Diamond drilling found a zinc horizon containing 11% zinc and no lead 1100 ft. down and just below the Pioche shale. No other mine in the district has such a horizon. The mine was rehabilitated, and a production of 250 tons of ore is being planned. Slushers are used to remove the ore. Some pumping is necessary. The ore is sent to a custom mill. W.D.F.

SEPARATE PUBLICATIONS

Apatite Belt of West Portland Township, Quebec. W. W. MOORHOUSE. *Quebec Dept. Mines Progress Rept.*, No. 178 (1943); reviewed in *Can. Mining Jour.*, **64** [7] 450 (1943). G.M.H.

Dolomite and Brucite Marble in the Scottish Highlands. W. Q. KENNEDY. *Geol. Survey Gt. Brit. Wartime Pamphlet*, No. 6 (1940–41). **Supplement No. 1.** W. Q. KENNEDY. **Supplement No. 2.** J. KNOX.—High-grade dolomite suitable for use as a basic refractory is available in large quantities in the Scottish Highlands, particularly in Sutherlandshire and Ross-shire, and in the Isle of Skye. The rocks belong to the Cambrian and Appin limestones. In some localities, notably Assynt and the Isle of Skye, the dolomite has been converted into brucite marble. The rock from the Durness formation has almost the same composition as pure dolomite and a specific gravity of 2.84 to 2.86. In the absence of chemical analyses, the specific gravity affords a good indication of the probable commercial value of a dolomite; it should not be less than 2.83. The specific gravity test should not permit dispensing with the cold dilute acid test for showing an excess of calcite, as the specific gravity does not fall below 2.83 until there is about 25% of calcite present. The dolomite in the Appin limestone formation in Argylshire and Inverness-shire contains less magnesia than pure dolomite. The white brucite marble consists of a mixture of calcite ($CaCO_3$) and brucite (MgO_2H_2). In the Tyrol such rocks are termed "pencatite." A typical composition is magnesia 25, lime 34, loss on ignition 39, and impurities 2%, corresponding to 62% calcite and 36% brucite. The gray and mottled brucite marbles contain a little forsterite or serpentine. Brucite marble may be identified by Lemberg's test, viz., heating a specimen 1 mm. thick over a spirit lamp to expel the combined water and, after cooling, adding silver nitrate. Brucite is stained dark brown or black, while calcite remains unstained. If the specimen is examined under a microscope (30×) the proportions of brucite and calcite may be estimated. Much of the calcite may be separated by calcining the marble at 900°C. and slaking with water, which reduces the lime to a fine powder readily separable from the granular crystals or periclase (MgO). A.B.S.

Dolomites and Limestones of Western Ohio. WILBER STOUT. *Geol. Survey Ohio Bull.*, 4th Ser., No. 42, 468 pp. (1941).—This report gives specific data on the geology and composition of the dolomites and limestones of western Ohio. Such information is much needed by both producers and users and is of interest in a general way to many others. The report gives a regional picture of the geology and a detailed study of the chemical composition and of the mineral components in the stone, but it makes no attempt to discuss quarrying methods, manufacturing processes, marketing conditions, etc. Twenty-two pages are devoted to utilization, including Portland cement, natural rock cement, Sorrel cement, grappier cement, silica brick, sand-lime brick, ceramic glazes, ceramic body flux, refractories, enamels, glass, and mineral wool. See "Ohio's . . . ," *Ceram. Abs.*, **19** [8] 198 (1940).

Introduction to Metal Mining in British Columbia. ANON. *Brit. Columbia Dept. Mines Bull.*, No. 17, 26 pp. (1943). 2 maps, 1 fig. Free.—Although this bulletin is intended to provide an outline of metal mining in the Province, there are excellent chapters on geological processes and on the physical geology of British Columbia. G.M.H.

Marketing Kyanite and Allied Minerals. NAN C. JENSEN. *U. S. Bur. Mines Information Circ.*, No. 7234, 20 pp. Free.—J. discusses the occurrence, properties, qualities, uses, and sources of supply of the "sillimanite group" (kyanite, andalusite, sillimanite, and dumortierite) and allied minerals (topaz and pinite). R.A.H.

Mineralogical and Chemical Studies of Soil Formation from Acid and Basic Igneous Rocks in Missouri. R. P. HUMBERT AND C. E. MARSHALL. *Univ. Missouri Agr. Expt. Sta. Research Bull.*, No. 359, 60 pp. (Jan., 1943).—The soils studied are from a granite porphyry and a diabase, both occurring in southeast Missouri. Microscopic examinations were made of the original rocks and of the different stages of weathering. The decomposition of the diabase involves practically all the rock constituents, whereas in the granite porphyry the minor constituents decompose first, followed by the orthoclase. The final breakdown of the quartz is physical. Mechanical analyses and fractionations were carried out as a preliminary to mineralogical studies of the soil. Mineralogical examinations of the heavy minerals (specific gravity 2.80) of the sand and coarse silt fractions of the two soils were

made. The appearance of epidote as a secondary product was clearly established. This provides a mechanism for the locking up of calcium in nonavailable form. Mineralogical examination of the light fractions gave a quantitative distribution of the quartz, feldspar, micas, and clays in the soil profiles. This illustrates both the clay formation and its translocation. The diabase profile shows also the formation of secondary micas and their eventual disappearance under weathering, together with a notable accumulation of secondary silica. In both soil profiles, translocation of clay downward has occurred. Electrical double-refraction measurements (granite soil only), refractive indices, and density determinations were used to characterize the clays. In addition, electron microscope studies of the 2 μ to 0.5 μ and 0.5 μ clay fractions of all horizons of both soils were made. These show that the clays are somewhat mixed in mineralogical character, with beidellitic clay predominating. Halloysite and magnesium bentonite were also identified. Chemical studies of the exchangeable bases showed that the granitic soil was exceedingly low in exchangeable calcium. 31 references.

Northwest Territories. ANON. Bureau of Northwest Territories and Yukon Affairs, Lands, Parks, and Forests Branch, Dept. of Mines and Resources, Canada, 1943. 52 pp., 1 map. Free.—The Territories are described from the standpoints of government, public welfare, transportation and communication, climate, minerals, water power, etc. G.M.H.

Prospector's Guide for Strategic Minerals in Canada. ANON. Mines & Geol. Branch, Dept. of Mines & Resources, Canada, 1943. 3d ed. 86 pp. Free.—Beryllium, chromium, columbium, manganese, mercury, molybdenum, tantalum, tin, tungsten, vanadium, fluorspar, Iceland spar, mica, and quartz crystals are of strategic importance. Each is discussed under the following topics: occurrence and formation, identification, marketable grades and specifications, buyers and prices, world production, and Canada's position. Most of these are not produced in Canada, and those that are produced are required in much greater volume. G.M.H.

Study of Some Chemical and Physical Properties of the Clay Minerals Nontronite, Attapulgite, and Saponite. O. G. CALDWELL AND C. E. MARSHALL. *Univ. Missouri Agr. Expt. Sta. Research Bull.*, No. 354, 51 pp. (Oct., 1942).—The clays investigated were nontronite from Sandy Ridge, N. C.; attapulgite from Attapulgus, Ga.; and saponite from Hector, Calif. Mechanical analyses were carried out down to 50 mμ. Electrodialysis of the whole clays showed that nontronite and attapulgite showed slight decomposition, whereas the saponite (magnesium bentonite) decomposed completely, with silicon moving with magnesium to the cathode chamber. The base-exchange capacities of various fractions of the three clays from 2μ to 50 mμ were determined, using ammonium at pH 7 and calcium at pH 5, 7, and 9. There was little variation with particle size and only slight differences between the treatments. Nontronite gave about 65, attapulgite 21, and saponite 80 m.e. per 100 gm. ignited clay. Titration curves are given for nontronite and attapulgite, using NaOH, KOH, $Ca(OH)_2$, and $Ba(OH)_2$. In the potassium series, the K^+ activities were also determined. Complete chemical analyses of the clay fractions are given. The results are interpreted on the basis of the atomic structures and are in agreement with those assigned. The exchangeable bases are supposed largely to balance the charge in the unit cell caused by atomic replacements. Dehydration studies were carried out on the various fractions. It was found that flakes or films give much higher moisture contents than ground clays. This is ascribed to water enmeshed in the structure, and this is difficult to distinguish from other forms of water present. Bradley's structure for attapulgite is modified slightly so as to provide 10 OH groups per unit cell instead of $4H_2O + 2OH$. Density determinations of the fractions were made in potassium mercuric iodide. Refractive indices were determined under a variety of conditions combined with different pretreatments of the fractions. Attapulgite is easily distinguished from clays of the montmorillonite group by the fall in refractive index which occurs on heating to 110°. The application of the Wiener theory to birefringence measurements on clay flakes is briefly considered. 73 references.

Yukon Territory. ANON. Bureau of Northwest Territories and Yukon Affairs, Lands, Parks, and Forests Branch, Dept. of Mines and Resources, Canada, 1943. 31 pp., 1 map. Free.—The main physical feature of the Yukon is a great basin-like area called the Yukon Plateau. Barriers around this and smaller basins include the St. Elias and Coast Mountains in the southwest and the Mackenzie Mountains on the east. The Territory has a very important gold production. Silver, lead, and copper are also produced. Coal output is determined by the local demand. Occurrences of tungsten, antimony, and other metals are known. There are many water-power possibilities. G.M.H.

Chemistry and Physics

Automatic apparatus for determination of small concentrations of sulfur dioxide in air. Application to hydrogen sulfide, mercaptan, and other sulfur and chlorine compounds. MOYER D. THOMAS, JAMES O. IVIE, JOHN N. ABERSOLD, AND RUSSEL H. HENDRICKS. *Ind. Eng. Chem., Anal. Ed.*, **15** [4] 287–90 (1943).—The automatic apparatus for the determination of small concentrations of sulfur dioxide in air has been modified by the substitution of a simple multiple-port stopcock-type valve for the numerous poppet valves of the older assembly. This equipment has also been modified to enable the simultaneous determination of the total volatile sulfur compounds in the air with the same precision and sensitivity as characterized the sulfur dioxide analysis. Carbon disulfide, hydrogen sulfide, ethyl mercaptan, thiophenol, and thiophene have been so determined. The method is also applicable (at a higher operating temperature) to organic chlorine compounds, such as chloroform, carbon tetrachloride, ethylene chloride, and chlorobenzene. Nitrogen compounds could not be oxidized to nitric acid in this equipment. Illustrated. F.G.H.

Chemistry of indium. Colorimetric method for the estimation of small amounts of indium. THERALD MOELLER. *Ind. Eng. Chem., Anal. Ed.*, **15** [4] 270–72 (1943).—The 8-hydroxyquinoline derivative of indium dissolves readily in chloroform, yielding yellow solutions which show a fairly broad absorption band in the region of 395 to 400 mμ. At 400 mμ, such solutions obey Beer's law in concentrations up to 18.0 mgm. of indium per liter of chloroform and lend themselves to the colorimetric estimation of the element. Indium ion can be completely extracted from aqueous solutions in the pH range 3.2 to 4.5 by shaking with a chloroform solution of 8-hydroxyquinoline. Of the commoner ions, only the following are extracted at pH 3.5 and therefore interfere with the colorimetric estimation of indium in the chloroform extracts: aluminum, stannous, bismuth, ferric, ferrous, cobalt, nickel, and cupric. Gallium and thallic ions also interfere. Indium can be estimated accurately in the presence of considerable quantities of zinc, cadmium, and lead ions, but it is impossible to determine indium accurately in ferric-indium ion solutions by extraction of ferric iron at a low pH and subsequent extraction of indium followed by colorimetric examination. The colorimetric procedure yields accurate results for indium concentrations in the interval of 0.3 to 20 mgm. per liter of chloroform or 0.015 to 1.00 mgm. of the metal in a 25-ml. aqueous solution. Analyses of samples containing larger amounts of indium should be possible through sufficient dilution of the chloroform extract. Illustrated. F.G.H.

Colorimetric determination of cobalt with *o*-nitrosoresorcinol. LYLE G. OVERHOLSER AND JOHN H. YOE. *Ind.*

Eng. Chem., Anal. Ed., **15** [5] 310–13 (1943).—A study of the reaction between cobalt and *o*-nitrosoresorcinol has shown that the reagent may be used for the colorimetric determination of cobalt. Spectrophotometric data for solutions of the reagent, for the cobalt complex, and for other metal complexes are presented. Procedures are given for the determination of cobalt alone and for cobalt in mixtures of nickel and cobalt. Illustrated. F.G.H.

Colorimetric method for determination of sodium. ERIC A. ARNOLD AND ALFRED R. PRAY. *Ind. Eng. Chem., Anal. Ed.*, **15** [4] 294–96 (1943).—A colorimetric method for sodium has been developed which depends on treating a solution of the triple acetate, precipitated by the method of Barber and Kolthoff or of Caley and Foulk, with an excess of ammonium carbonate and hydrogen peroxide; this develops an orange- to red-colored solution. When using a narrow wave band, this color is proportional to the concentration of sodium ion in solution. The transmittance-concentration curve for these solutions has been run over the spectral range from 3700 to 7700 a.u. A wave band of 5200 a.u. was chosen for this comparison. Various factors affecting the stability of the color were investigated and are reported. Illustrated. F.G.H.

Determination of atomic distances in compounds from indices of refraction. E. KORDES. Presented before Chemiedoz. Mittel und Ostdeut., Jena, July 1939; reviewed in *Angew. Chem.*, **52** [31] 513–14 (1939).—The method of determining ionic and atomic distances in crystals and glasses from molar refractions is described. See "Physicochemical . . . ," *Ceram. Abs.*, **19** [1] 10 (1940).

Determination of iron in presence of chromium and titanium with Jones reductor. F. S. GRIMALDI, R. E. STEVENS, AND M. K. CARRON. *Ind. Eng. Chem., Anal. Ed.*, **15** [6] 387–88 (1943).—Sulfuric acid solutions of titanous and chromous sulfates, obtained by passage through the Jones reductor, are oxidized by aeration for 5 to 10 min. in the presence of a trace of copper sulfate as a catalyst. Ferrous sulfate is essentially unoxidized and is titrated with permanganate after aeration. Best results are obtained by using 0.0003 millimole of copper sulfate in about 300 ml. of solution. Larger quantities of copper sulfate lead to slightly low results when both chromium and titanium are present. F.G.H.

Determination of precision of analytical control methods. RAYMOND F. MORAN. *Ind. Eng. Chem., Anal. Ed.*, **15** [6] 361–64 (1943).—For the intelligent control of plant operations and product quality, the precision of the analytical control methods must be quantitatively known. The use of statistical reasoning based on the standard deviation has been found applicable. The analytical method is first tested under ideal conditions to find the highest precision of which the method is capable. If this precision is judged high enough, the method is then tested in routine practice for a year to discover the variability under routine laboratory conditions. An LU_2 (limit of uncertainty) can then be calculated within which routine analyses may be guaranteed. The average of duplicate determinations made at the same time does not result in as much improvement as may be theoretically calculated, evidently because the results are not truly random. Normal control methods were found to have 1.5 to 2.5 as much variation under routine conditions as the same method under the best conditions. The use of this method of criticism has proved a valuable tool in the author's laboratories. F.G.H.

Equilibrium diagram of the Fe–Al–Si system. SYUZO TAKEDA AND KENSUKE MUTUZAKI. *Tetsu-to-Hagane*, **26**, 335–61 (1940); abstracted in *Chem. Age* [London], **45** [1158] 133 (1941).—By microscopic observation and thermal, X-ray, magnetic, and dilatometric investigations, the existence of the ternary compounds $Fe_3Al_3Si_2$, $Fe_8Al_{12}Si_5$, $Fe_5Al_9Si_5$, $FeAl_3Si_2$, $Fe_6Al_{15}Si_5$, and $FeAl_4Si$ was determined. A.B.S.

Extraction and colorimetric estimation of certain metals as derivatives of 8-hydroxyquinoline. THERALD MOELLER. *Ind. Eng. Chem., Anal. Ed.*, **15** [5] 346–49 (1943).—Spectrophotometric examinations of chloroform solutions of certain metal derivatives of 8-hydroxyquinoline indicate the following absorption maxima: ferric iron 470 and 570, aluminum, bismuth, and nickel 395, cobalt 420, and copper 410 mμ. Agitation of aqueous solutions containing these metallic ions with a chloroform solution of 8-hydroxyquinoline leads to complete extraction of the metallic complexes in the following optimum pH ranges: iron 1.9 to 3.0; aluminum 4.3 to 4.6; bismuth 4.0 to 5.2; cobalt 6.8 or above; nickel 6.7 or above; and copper 2.7 to at least 7.0. At pH values below the lower limits, partial extraction to no extraction will occur. Chloroform solutions containing the equivalents of up to 20 mgm. of these metals per liter (or 1 mgm. of the metal in the aqueous solution extracted) show little or no deviation from Beer's law at the wave lengths given and thus lend themselves to use in accurate colorimetric determinations. Copper can be determined in the presence of at least forty times as much cadmium or zinc by extraction at pH 4.0 and transmittancy measurement at 410 mμ. An interesting correlation between pH values for hydrous oxide or hydroxide formation, quinolate precipitation, and quinolate extraction is given. Illustrated. F.G.H.

Fritting of one-component powders. Study of the processes of powder metallurgy and ceramics: III, Comprehensive report on the course of chemical processes involving solids, (1) Systematics and thermodynamics of fritting processes. G. F. HÜTTIG. *Kolloid-Z.*, **97** , 281–300 (1941); *Chem. Abs.*, **36,** 6860 (1942).—The processes that may occur in homogeneous solid chemical substances, whether of chemical, physical, or mechanical nature, can be classified in six groups, according to the manner and direction of the force that produces a change of state. These six groups can be split into 15 subdivisions depending on the various limiting conditions that are required to describe the process as fritting. A number of experimental difficulties must be overcome to obtain unexceptional fritting processes that agree with the definition given. The history and the literature on fritting is reviewed. A thermodynamic approach to the subject is made with the aid of the energy relation disperse state → single crystal + ΔF cal. The complex-chemical concept of crystal structure involving the affinity of formation and decomposition of complex compounds can also be applied to the phenomena of fritting. From the thermochemical data available in the literature, there appears to be no definite proof for the thermodynamical inference that a single crystal must be the final result of the fritting process. It is more likely that a definite degree of dispersion corresponds to each given temperature. ***(2) Experimental data on fritting.** *Ibid.*, **98** [1] 6–33 (1942).—A critical review of the available data on the changes occurring when a homogeneous powder is submitted to a constantly increasing temperature is presented. The powders considered are Cu, Fe, Sn, Pb, Au, Ni, Mo, W, Fe_2O_3, Al_2O_3, ZnO, BeO, CuO, Fe_3O_4, Al, NaCl, some glasses, and some organic compounds. The changes taking place were studied by determining the e.m.f., solubility, chemical reactions with various liquids, adsorption isotherms for MeOH, density (vacuum pycnometer), molecular volume, volume weight, catalytic capacity, electric resistance, gas desorption, strength, hardness, increase in particle size (microscopic and roentgenospectroscopic methods), adsorption capacity for dissolved dyes, and other properties. ***(3) Schematic description of the fritting process.** *Ibid.*, [3] 263–86.—H. collected a large volume of data on the changes occurring in the above-mentioned properties of metal and metal oxide powders when they are exposed to a constantly increasing temperature. These data, obtained by various methods, were arranged in a family of diagrams, the temperature axes of which are divided into fractions, a, of the absolute melting point. The diagrams show that the same property appears in different materials in essentially the same manner, i.e., a certain property will display the same characteristics in various materials at essentially the same value of a, although the absolute value of the temperature may be quite different. Previously advanced theories on

* Obtained from microfilm.

fritting are reviewed and compared. The changes taking place on the surfaces and within individual crystals and the interaction of neighboring crystals upon exposure to a constantly rising temperature are explained by the elementary changes of these crystals upon fritting. The changes in the properties are examined from the viewpoint of their causes. This enables H. to construe a model of the course of fritting. The entire process is divided into six distinct periods, each being characterized by some occurrence which is more pronounced in this particular period than in any of the other five. Thus, in period (1), temperature $a = <0.23$, only such changes occur, when the temperature increases, which are generally connected with aging of the surface. The chemical potential, i.e., the adsorption capacity, declines. Period (2), $a = 0.26$ to 0.36, is characterized by a general increase in activity, which is caused by surface diffusion. The chemical potential increases. In period (3), $a = 0.33$ to 0.45, the increase in activity ends and unhindered aging sets in. This condition is caused mainly by adhesion. In period (4), $a = 0.37$ to 0.53, the activity rises again, this time because of a new rearrangement induced by lattice diffusion. In period (5), $a = 0.48$ to 0.8, the second activation period is terminated. Complete aging sets in, heading in the direction of formation of a single crystal. The chemical potential declines finally, the total surface area contracts, and the volume of capillaries decreases. The last period, (6), $a = >0.8$, is characterized by reactivation preparatory to melting. Deviations from this model and their causes are discussed. M.Ho.

HCl test on arsenic and sulfuric acid. L. VIELHABER. *Beizerei* (in *Emailwaren-Ind.*, **18** [41–42]), pp. 19–20 (1941); abstracted in *Chem. Zentr.*, **1942, II** [6] 693.—(1) Arsenic: 10 cc. of HCl is mixed with 5 cc. of a 10% solution of $Fe_2(SO_4)_3$ and diluted to 50 cc. Then H_2S is introduced for 20 min. The solution is transferred together with the precipitate into a 100-cc. tube and left to settle 4 hr. The As content is determined by the height of the precipitate by the use of a table. (2) H_2SO_4: In the same manner the H_2SO_4 content is determined: To 20 cc. of the HCl is added a solution of $CaCl_2$ of 30° Bé. at 15° to 17° up to 100 cc. After 3 hr. the height of the precipitate is read. Tables are given in the original paper. M.V.C.

Psychophysical significance of dissipation coefficient of soft materials. G. W. SCOTT BLAIR AND F. M. V. COPPEN. *Nature*, **149** [3766] 22–23 (1942).—For materials the firmness (ψ) of which is independent of stress, k is defined by an equation of the Nutting type, $\psi = S\sigma^{-1}t^k$, where σ is shear strain and t is time. According to Broome and Blimes, k is also given by the ratio of mean to differential viscosity $\left(S/\frac{\sigma}{t} \div S/\frac{\partial\sigma}{\partial t}\right)$, and for relaxation at constant strain, differentiation shows that the Maxwell relaxation time will vary as a power $(1/k)$ of the stress. To establish the psychophysical significance of k, the authors gave pairs of cylinders to groups of ten subjects who, squeezing the cylinders under controlled conditions, were asked to decide which was the firmer of each pair, the squeezing time being 1/2, 1, 2, and 4 sec. When a standard bitumen (viscosity = η; $k = 1$) is compared with a series of rubbers ($k = 0$) of varying shear moduli (n), a unique curve is obtained when p (percentage "bitumen softer" answers) is plotted against nt. The time required to give an equality point corresponding to the case where η is numerically equal to n is not equal to the time unit from which η is calculated (1 sec.) but to a fraction ($\alpha = 1/3$) of this value. To study further the relationship between α and the difference between the k values of the materials (Δk), further experiments were carried out with ten subjects giving three sessions per experiment and 32 judgments per session, i.e., 960 judgments per experiment. A series of fluid bitumens was compared with (1) an unvulcanized rubber ($k = 0.50$; $\psi = 2.5 \times 10^6$); and (2) a synthetic rubber-clay-vaseline mixture ($k = 0.22$; $\psi = 4.0 \times 10^6$). The Δk-values were 0.50 and 0.78. From subjective comparisons of the firmness of a material with that of a true fluid, the dissipation coefficient can be derived. In experiment 1 α is 0.98 and in 2, 0.45. G.A.K.

Semimicroanalysis of saline soil solutions. R. F. REITEMEIER. *Ind. Eng. Chem., Anal. Ed.*, **15** [6] 393–402 (1943).—A system of photometric and volumetric analytical semimicromethods for ions that contribute to soil salinity is described. These methods involve a considerable reduction in the quantity of soil solution required, which is an important consideration in the extraction of such solutions. In addition, they involve a saving of reagents and time. The precision and accuracy of the methods are considered adequate for most soil analyses. Illustrated. F.G.H.

Silicon oxide bands. L. H. WOODS. *Phys. Rev.*, **63** [11–12] 426–30 (1943).—Pankhurst has described a band spectrum believed by him to belong to an oxide of silicon, possibly SiO_2. A better excitation of the same bands has been obtained from a similar source (a high-voltage uncondensed discharge through a constriction in a quartz tube), but in helium gas instead of hydrogen. These bands have been photographed on the 30-ft., 30,000 lines per in. Chicago grating spectrograph. A band near λ 3840 has been resolved in the first and second orders and found to be a (0,0) transition, overlapped by a weak (1,1) transition, of the type $^2\Sigma \rightarrow {}^2\Sigma$ having the constants v (0,0) = 26,015.05 cm.$^{-1}$, $B_0' = 0.7180$ cm.$^{-1}$, $B_0'' = 0.7253$ cm.$^{-1}$, v (1,1) = 25,991.44 cm.$^{-1}$, $B_1' = 0.704$ cm.$^{-1}$, $B_1'' = 0.712$ cm.$^{-1}$. The coefficients of the spin doubling for the two states are $\gamma_0' = +0.012$ cm.$^{-1}$, $\gamma_0'' = +0.002$ or $\gamma_0'' = +0.022$ cm.$^{-1}$, the value of γ_0'' not certainly fixed as between these two alternatives. The doublet structure and the B values prove that the emitter is SiO^+. Other bands at λ 4270 have been resolved with weak intensity and tentatively ascribed to SiO_2. G.A.K.

Thermal-expansion characteristics of calcium aluminates and calcium ferrites. G. R. RIGBY AND A. T. GREEN. *Bull. Brit. Refrac. Research Assn.*, No. 60 (Sept., 1941); reprinted in *Trans. Brit. Ceram. Soc.*, **42** [5] 95–103 (1943).—The percentage reversible expansion of the calcium aluminates decreases as the alumina content increases. The mineral $3CaO \cdot 5Al_2O_3$ has an exceptionally low coefficient of expansion, particularly between 20° and 500°C. The thermal expansions of the minerals containing ferric oxide are high and of the same order as that of ferric oxide. A product consisting of $MgO \cdot Al_2O_3$ and $3CaO \cdot 5Al_2O_3$ and made by firing a mixture of dolomite and aluminum hydroxide is described. The steam hydration index of each mineral has also been determined in view of the importance of these minerals as constituents of Portland and aluminous cements. R.A.H.

X-ray diffraction pattern of tricalcium aluminate. LYNN J. BRADY AND WHEELER P. DAVEY. *Jour. Chem. Phys.*, **9**, 663–66 (1941); *Chem. Abs.*, **35**, 7260 (1941).—The diffraction pattern of $3CaO \cdot Al_2O_3$ was recorded (intensity vs. angle). The unit cube contains 264 atoms and has an edge of 15.235 a.u.

PATENTS

Luminescent material and method of producing. R. C. HULTGREN AND SAMPSON ISENBERG (General Luminescent Corp.). U. S. 2,324,843, July 20, 1943 (Nov. 30, 1939).—The method of producing luminous magnesium tungstate which comprises mixing together stoichiometric proportions of materials which on heating will produce magnesium tungstate, heating such materials at a sufficiently high temperature to cause reaction, mixing the compound with a small proportion of magnesium oxide and a sufficient proportion of an innocuous volatile liquid to form a relatively thin paste, ball milling such mixture until substantially the minimum particle size obtainable by progressive grinding in a ball mill is reached, drying the ground product, and then refiring it.

Method of obtaining magnesium oxide from substances containing it. DYNAMIDON-WERK ENGELHORN & CO. G.M.B.H. Belg. 428,600, July 30, 1938.—The parent material is calcined and subsequently treated with a phenol in the presence of water. The oxides other than MgO are transformed into phenolates which remain in

solution, whereas the MgO is precipitated as a slime. This slime is utilized in the manufacture of refractories. M.Ho.

Powdered alkali silicates. Soc. Anon. La Floridienne J. Buttgenbach & Co. Belg. 433,808, May 31, 1939.—A solution of alkali silicate is coagulated. The whole is allowed to stand, care being taken to prevent the evaporation of the coagulant. It is kept thus until a hard and friable mass separates from the liquid. M.Ho.

Preparation of pure cryolite. Silikon G.m.b.H. Ausarbeitung und Verwertung Industrieller Verfahren. Belg. 433,554, April 29, 1939.—An equivalent mixture of AlF_3 and alkali fluosilicate is heated at 450° to 500° in an inert atmosphere or *in vacuo*. M.Ho.

General

Action of bentonite clay in stopping leaks in water-supply reservoirs. Anon. *Water and Sewage*, **81** [2] 14–15 (1943).—The use of the dispersion, dry, and sprinkle methods is described. B.L.

Ceramic research at University of Illinois. Anon. *Bull. Amer. Ceram. Soc.*, **22** [8] 276 (1943).—A research project accepted by the University of Illinois will involve studies on porcelain enamels and other ceramic coatings for use on the exhaust systems of airplanes. See "Porcelain . . .," *Ceram. Abs.*, **22** [5] 68 (1943).

Further studies of aluminum powder in the treatment of silicosis. J. L. Blaisdell. Presented at meeting of Industrial Hygiene Foundation of America, Inc., Pittsburgh; abstracted in *Can. Chem. & Process Inds.* (Can. Lab.), **27** [1] 40 (1943).—The use of aluminum dust seems to be followed by amelioration of symptoms and increased capacity for work. B.L.

Fusion method for the determination of free silica in industrial dusts. Alfred Salazar and Leslie Silverman. *Jour. Ind. Hyg. & Toxicol.*, **25**, 139–48 (April, 1943).—A new method based upon the fusing of all but the free-silica particles has been developed; the dust sample is passed directly through a controlled flame. The fused sample, collected by an electric precipitator, is removed to a microscopic slide for analysis. The method may be applied to air-borne or to rafter dust samples. A direct count of both fused and unfused particles will determine the amount of free silica. Possible interfering materials (refractories and those which decrepitate at high temperatures) are uncommon and may be identified, when present, by their optical characteristics. Possible particle-size variation in the transfer fields is eliminated by carrying out the method in each microscopic field. The method can also be used with standard photographic technique, the fusion reducing the number of particles to be identified if several refractories are present along with fusible materials. K.R.

Music to step up production. G. C. Keith. *Jour. Can. Ceram. Soc.*, **12**, 9–12 (1943).—K. describes the results of the experiments of several Canadian manufacturers in supplying music to workers during factory hours. Programs of carefully selected music have been found beneficial in promoting contentment among workers and increasing production. G.A.K.

New projects at the Engineering Experiment Station, Ohio State University. Anon. *Bull. Amer. Ceram. Soc.*, **22** [8] 300 (1943).

Occupational disease considerations. Emery R. Hayhurst. *Ind. Med.*, **12**, 443–46 (July, 1943).—The term "occupational disease" is difficult to define, referring as it does at present to industrial, medical, insurance, and legal aspects. From July 31, 1937, when silicosis became compensable in Ohio, to Feb. 28, 1943, 1179 claims were filed. Of these 515 were allowed, 543 disallowed, and 121 were pending. Among sources of the 515 allowed were foundries 278 (54%) and ceramics 167 (32%). The number of fatal cases and permanent total disabilities due to silicosis represent the great increase in the cost of occupational diseases. Foundries and ceramics accounted for 87.7% of the silicosis claims allowed by the Industrial Commission up to June 30, 1942. Occupational trends may also be estimated from the number of articles appearing in the literature on occupational diseases and industrial hygiene, which totaled 3282 from 1935 through 1940, the principal subjects being, in descending order, dust, lead, silicosis, skin diseases, carbon monoxide, and gases. K.R.

Problem of industrial hygiene. James G. Townsend. *Ind. Med.*, **12**, 503–504 (July, 1943).—Wartime conditions have brought out new solvents of unknown toxicity, and old materials such as benzine and carbon tetrachloride, banned as dangerous to workers, have been coming back. One company had so restricted the use of benzol that none was found in its plant, and the present industrial hygienists, who were permitting its use for polishing reflectors, were surprised to learn it was considered a toxic substance. The silicosis hazard associated with abrasive blasting operations is increasing in magnitude since it became necessary in both new and old installations to return to the use of silica sand as an abrasive instead of steel shot or grit. The substitution of silicon carbide cutting instruments for those of steel introduces new dust hazards which may prove detrimental to the health of workers and will certainly affect production. K.R.

Response of a Gulf coast drilling mud to chemicals, temperature, and heat-treatment. George Fancher and Robert L. Whiting. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1589; *Petroleum Tech.*, **7** [2] 15 pp. (1943).—A typical drilling mud from the Hastings oil field, Brazoria County, Texas, containing only 8% (dry basis) of material of colloidal dimensions, which was largely illite, was concentrated to a density of 10.2 lb. per gal. The effects of water dilution, treatment with complex polyphosphates, temperature, and the time of heating upon the rheological properties of the mud were investigated. It was found that water plays an important part in chemical treatment and that sodium acid pyrophosphate and sodium tripolyphosphate were more efficient than other complex polyphosphates for chemical treatment. Muds treated with either of these chemicals manifested maximum reduction in viscosity and minimum filtration rates at low concentrations. Furthermore, mud treated to minimum viscosity with either of these two chemicals was virtually unaffected by heat-treatment. W.D.F.

Edwin and Mary Scheier. Anon. *Bull. Amer. Ceram. Soc.*, **22** [8] 263–70 (1943).—Ten photographs, two references.

Steam versus electricity in brickworks. E. Thompson. *Claycraft*, **16** [6] 193–200 (1943).—In view of the present shortage of fuel, T. discusses the merits of steam vs. electricity as a source of power from the standpoint of economy. A steam plant comprises a boiler and stack, a water pump or injector, and an engine. In addition, boiler insurance, boiler inspection, water supply, lubricating oils, and fuel supplies are required. In the ceramic industry, steam is one of the best forms of drying owing to its uniformity and lack of hot spots. Exhaust steam is exceptionally good. A steam plant requires a great deal of care and maintenance. Electricity can be used at any time by touching a switch, and the users have no fuel worries or labor requirements. An electric plant comprises a transformer and switch house, maintained normally by the power company, cables, motors, switches, and starting gear. Electric motors have many advantages over any other type of driving power. If a machine should be overloaded, the motor should stop itself. An electric motor is nearly always fitted with an ammeter to indicate the load. T. concludes that electric drive has many advantages over steam in a firebrick plant. G.A.K.

Tripoli and silicosis. Carey P. McCord, S. F. Meek, and G. C. Harrold. *Ind. Med.*, **12**, 373–78 (June, 1943).—A few unquestionable cases of silicosis following exposure to tripoli have occurred in recent years. Although tripoli contains free silica usually in excess of 98% and fre-

quently exists in industry in a highly fine particulate size, the clinical incidence of silicosis among tripoli workers has been low and almost nonexistent. Experimental tissue proliferation characteristic of silica action may, however, easily be induced by tripoli. The term "tripoli" is widely applied to a group of comparatively soft, highly porous, friable, microcrystalline forms of sedimentary silica. Its origin is in doubt. The X-ray pattern is that of quartz. Four natural properties or artificial states which probably act as a deterrent to the action of this mineral with its high silica content are discussed. K.R.

PATENTS

Destruction of froth in froth flotation of minerals. WESTFALIA-DINNENDAHL-GROPPEL A.-G. Belg. 430,986, Dec. 31, 1938.—The froth-containing mixture is centrifuged in a deairing centrifuge, thereby destroying the air bubbles. The liquid and solid phases are then removed from the centrifuge. M.Ho.

Improvement in the manufacture of ceramic ware. G. HEINZ AND E. B. CARTER. Belg. 429,588, Sept. 30, 1938.—The ceramic body is mixed with latex which serves as a temporary binder. The latex is eliminated in the firing. M.Ho.

Improving glass, glazes, and enamels. DEUTSCHE TAFELGLAS A.-G. (Detag). Belg. 429,766, Sept. 30, 1938; addition to Belg. 412,112.—The mass is either molded or cooled under conditions where the water-vapor content is similar to that of the natural atmosphere or in an atmosphere containing no water vapor. M.Ho.

New product resembling asbestos. W. LUDKE. Belg. 433,100, April 29, 1939.—The product contains MgO, SiO_2, 3 to 15% Na_2O, and 15 to 16% F. The volume weight of the product is 0.2 to 0.6. M.Ho.

Water-soluble beryllium phosphate glass. MILTON WILLIAMS (Standard Oil Development Co.). U. S. 2,324,124, July 13, 1943 (Sept. 21, 1937).—The method of improving a drilling mud which comprises adding thereto a water-soluble glass comprising an alkali-metal phosphate homogeneously associated with an oxygen-containing compound of beryllium.

World Affairs Go Merrily On
Motivated By Personal Ambitions
Each Nation Suffering Or Prospering
According To The Personal Desires
Of Its Lawmakers

In American Democracy
Persons Have And Should Continue To Enjoy
- - - - - - *Free Enterprise* - - - - - -
To Select Their Lawmakers
To Agree On Rules Governing Cooperative Affairs
To Equip Themselves To Earn Compensation
For Services Rendered

Each Person In A Democracy
Must Find Time To Read
Or Lose Touch With His Own Affairs

This Is Why *Ceramic Abstracts* Are
Compiled And Published Monthly

THE BULLETIN SECTION

Volume 22 September 15, 1943 Number 9

MILMAN·H. LINN, SR.

MILMAN H. LINN, SR.

For Fifty Years a Progressive Potter

A grand man, broad and liberal in thought and deed. Always progressive, Milman H. Linn readily invested in labor-saving equipment, thus keeping his factory processes modern. He followed the transition from hand-thrown stoneware crocks, jugs, jars, and churns for farm and town households to the cast and jiggered utility, cooking, and architectural stoneware of the present day. He pioneered in the transition from salt and slip glazing to the opaque and colored Bristol and the fritted-lead, high-gloss glazes. With all his promptness in modernizing, he was conservative and frugal. He possessed a progressive, sound business judgment. The Zanesville Stoneware Company has continued as a leader, since it was organized in 1889, under the management of Milman H. Linn, Sr.

Mr. Linn passed away August 11, 1940, in Zanesville, Ohio, at the age of seventy-nine. To each of about forty employees who had been with the Company for ten or more years he bequeathed one hundred dollars, the inheritance being paid by the estate. The Company stock and his other holdings were bequeathed to his children, three sons and one daughter. His wife, Jane Davey Smith, to whom he was married June 20, 1900, died in 1911.

Native Ohioan

Milman H. Linn, the fourth child of Daniel Bliss and Mary Dana Linn, was born May 15, 1861, in an old stone cottage at Norval Park, then the family homestead. He attended a rural public school and was graduated from Zanesville High School at the age of fourteen.

His father, Daniel Bliss Linn, a former editor of the *Zanesville Signal*, was a local attorney who had come from McConnelsville, Ohio. On his mother's side, he was descended from Captain William Dana, a pioneer settler in the Ohio Valley.

His first regular employment was with a wholesale grocery firm in Louisville, Kentucky. After he had been in Louisville about two years, the late Wheeler Stevens asked him to return to Zanesville to join his firm, also wholesale grocers. This connection lasted for more than twelve years.

Mr. Stevens, who had an investment in the Zanesville Stoneware Company, was then instrumental in persuading Mr. Linn to shift his activities to the pottery business. A director of the Company since its incorporation in 1889, Mr. Linn went to the Zanesville Stoneware Company in 1893 and subsequently became its president, general manager, and majority stockholder.

Milman H. Linn was one of the last of the "old guard" of manufacturers who did so much to make Zanesville nationally famous as a pottery center, and he was always a strong supporter of any project which would contribute to the general welfare. He was a member of the Zanesville Chamber of Commerce and a charter member of the Zanesville Golf Club, and, as a lifelong member of the Putnam Presbyterian Church, had served the church in various capacities.

He loved to travel and, in addition to many extended trips in this and adjacent countries, had crossed to Europe four times.

CONTROL OF ATMOSPHERE IN LABORATORY KILNS*

By C. L. Thompson

Abstract

The control of furnace atmosphere in reheat, load-test, and P.C.E. furnaces by the use of air-gas proportional mixers is described. The effect on the ability to reproduce test conditions is discussed.

I. Introduction

A high-temperature gas-fired testing furnace using an automatically proportioned air-gas mixture has been described.[1] This type of firing equipment has been installed on all gas-fired testing furnaces at Hays Laboratory, which include reheat, load-test, and P.C.E. furnaces. A brief description of the furnaces and the results obtained should be of interest in these days of rapid turnover of personnel which requires the use of inexperienced kiln operators. The ease of operation of these furnaces and the fact that the furnace atmosphere does not need adjustment by the operator make them a distinct asset under present conditions.

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (Refractories Division). Received April 15, 1943.

[1] C. L. Thompson and H. G. Wilcox, "High-Temperature Gas-Fired Test Furnace," *Bull. Amer. Ceram. Soc.*, **19** [9] 336–37 (1940).

II. Description of Furnaces

(1) Reheat Furnaces

There are two reheat furnaces. One of them, of the same size and design previously described,[1] has a hearth 2 ft. 6 in. by 3 ft. 4 in.; the other is similar but smaller in size, with a hearth 20 in. by 2 ft. 8 in. The maximum gas-burning capacities of the furnaces are 4000 and 2700 cu. ft. natural gas per hour, respectively. Air from one $7^1/_2$-h.p. Spencer turbocompressor is delivered to either or both furnaces by a manifold. The furnaces are shown in Figs. 1 and 2.

(2) Load-Test Furnaces

The load-test furnaces are of the conventional cylindrical design with two proportional mixer burners which discharge tangentially into the heating chamber. The burners on one furnace have a total maximum capacity of 600 cu. ft. of gas per hour; the other furnace, which is used

at higher temperatures, has a total capacity of 800 cu. ft. per hour. Tests have been made in the latter furnace at temperatures up to 3190°F. (1755°C.). When first put into operation, the temperature was considerably lower in the center of the furnace than at the face of the test brick nearest the furnace wall. This condition had not been encountered in the same furnace fired with high-pressure gas burners. Apparently the low-pressure air-gas stream is not sufficiently turbulent, and the difficulty was easily overcome by installing a baffle in front of each burner to increase the turbulence. The load-test furnaces are shown in Figs. 3 and 4.

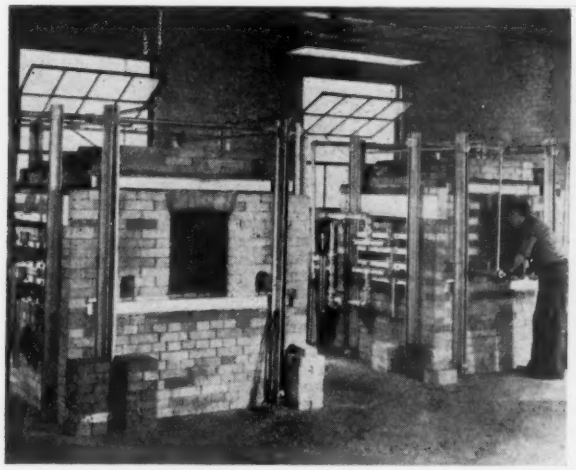

FIG. 1.—The reheat furnaces.

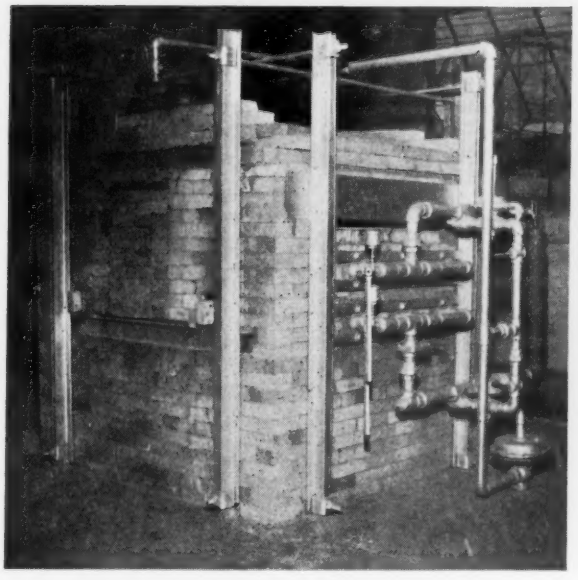

FIG. 2.—One of the reheat furnaces showing mixers and piping.

(3) P.C.E. Furnaces

The P.C.E. furnaces are the Denver Fire Clay Company's type No. 392, with their mixer replaced by a McKee proportional mixer having a capacity of 300 cu. ft. of gas per hour. In this furnace, cone 35 can be brought down on the A.S.T.M. schedule. Higher temperatures may be reached by using oxygen, but this defeats the purpose of the mixers, as manual adjustments of the gas-air mixture must be made while oxygen is being used, and the mixer then must be readjusted at the end of the run for use without oxygen. In normal use without adding oxygen, the operator has only the one valve to open to increase the flow of the air-gas mixture in accordance with the predetermined schedule.

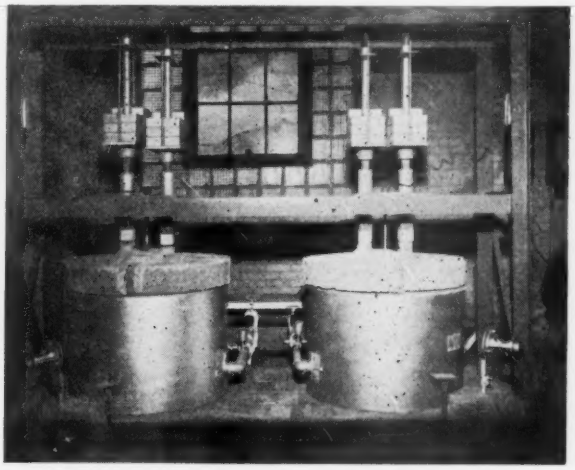

FIG. 3.—The load-test furnaces.

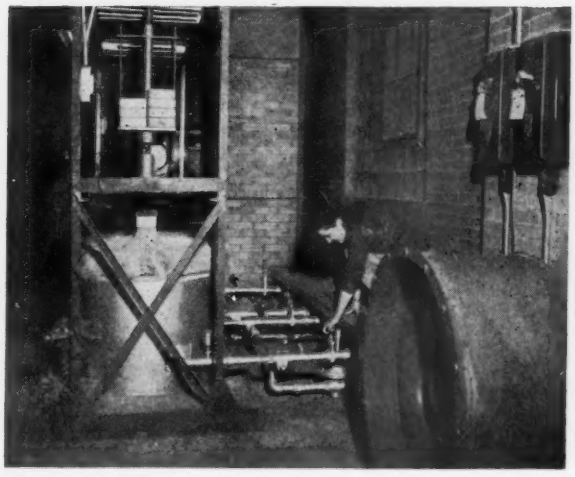

FIG. 4.—Load-test furnaces showing compressor and piping.

One turbocompressor supplies air for two P.C.E. furnaces and two load-test furnaces. The P.C.E. furnaces are shown in Fig. 5.

III. Results Obtained

Among the advantages of the furnaces are the ease of operation and the uniformity of furnace atmospheric conditions.

As all burners are equipped with manometers or pressure gauges that show the mixture pressure at the burner, it is

easy to work out a schedule that can be followed by an inexperienced operator. Slight deviation from the schedule will be necessary owing to variation in pressure within the furnace from test to test.

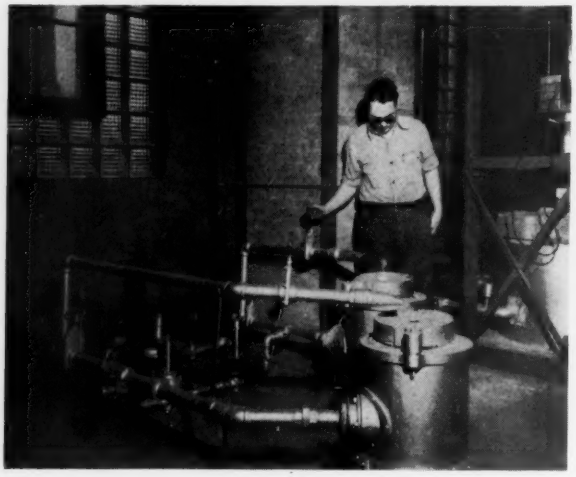

FIG. 5.—P.C.E. furnaces.

Relatively uniform furnace atmospheres can be maintained throughout all tests. Although it is not claimed that the mixers will proportion perfectly over the entire range used nor that the oxygen content of the kiln gases will be exactly the same in all tests, it has been established that oxidizing conditions can be maintained. This makes the reproduction of test results more easily attained, eliminates many spoiled tests due to inexperience of the operator, or the more serious use of inaccurate results due to an unknown period of reduction during a night shift.

Typical Orsat analyses of furnace gases are shown in Tables I to III. The variation in oxygen content for a given percentage of carbon dioxide has been noted and checked frequently from time to time and is apparently not always due to errors in analyses. Calculated from analyses supplied by the gas company, the flue gases should contain 12.1% carbon dioxide for theoretically perfect combustion and 11.0% carbon dioxide and 2.0% oxygen when using 10% excess air.

Acknowledgment

The writer wishes to express his indebtedness to members of the Industrial Utilization Division of the Equitable Gas Company for suggesting the type of equipment and help in installing it. He is also indebted to many of his colleagues at Hays Laboratory for their help, particularly Alfred W. Allen for the flue-gas analyses and C. F. Bruce whose supervision has made the fine results possible.

HAYS LABORATORY
HARBISON-WALKER REFRACTORIES COMPANY
HAYS, PITTSBURGH, PENNSYLVANIA

TABLE I

REHEAT FURNACE

2910°F. (1600°C.) Reheat

Temp. (°F.)	CO_2 (%)	O_2 (%)	CO (%)
500	4.7	8.1	0.0
1200	9.7	4.5	0.0
1910	10.9	2.5	0.0
2190	10.2	2.2	0.0
2390	9.8		
2510	10.2	2.2	0.0
2650	10.2	2.2	0.0
2750	10.1	2.3	0.0
2850	10.2	2.2	0.0
2910	10.5	1.9	0.0
2910 (2 hr.)	10.1	2.4	0.0
2910 (3 hr.)	10.0	2.5	0.0

TABLE II

LOAD-TEST FURNACE

2640°F. (1450°C.) Test

Time (hr.)	Temp. (°F.)	CO_2 (%)	O_2 (%)	CO (%)
1	1000	7.4		
2	1810	9.4	2.2	0.0
3	2260	10.0	1.0	0.0
4	2530	10.0	0.6	0.0
5	2640	10.0	1.4	0.0
6	2640	10.2	1.4	0.0

3000°F. (1650°C.) Test

Temp. (°F.)	CO_2	O_2	CO
2810	11.6	0.1	0.0
2910	10.0	0.9	0.0
2910 (1 hr.)	11.2	0.2	0.0

TABLE III

P.C.E. FURNACE

(Standard Schedule)

Temp. (°F.)	Cone	CO_2 (%)	O_2 (%)	CO (%)
	November 18, 1942			
2350		9.7	0.5	1.8
2750	20	10.2	0.6	0.2
2950	27–28	11.6	0.2	0.4
3060	31–32	10.4	0.6	0.2
3150	32 1/2–33	10.6	0.3	0.4
3180	34	11.2	0.2	0.4
	February 10, 1943			
2200		9.2	0.5	1.3
2500		9.9	0.4	1.6
2750	20–26	10.7	1.1	0.2
2900	29	11.0	1.3	0.2
3050	30–31	11.3	1.5	0.2
3150	33	10.9	1.9	0.2

THAT KILGORE BILL—Have you sent your protest to your senators and congressmen? This bill *must* be killed or development in science and technology will be hamstrung. *See Bull. Amer. Ceram. Soc.*, **22** [6] *209–10;* [7] *260–61;* [8] *288–90 (1943).*

MODULARIA*

By Frederick Heath, Jr.

What Is Modularia?

Very little is known about this strange disease except that it exists and is spreading rapidly.

Symptoms

Victims become possessed with an urge to eliminate needless waste in building construction. They are particularly receptive to methods of simplification whereby things are done the easy way. They have an exceptional aesthetic appreciation of good architectural design based on true proportions of parts. They become impatient to accomplish these worth-while things and to live a peaceful and better life.

Those who have never been contaminated with this peculiar disease are satisfied with things as they are. They do not recognize that waste exists in building construction. They prefer to do things the hard way. They are intolerant with reformers who disturb the *status quo*.

When the Disease Was First Known

Historical records and the remnants of ancient buildings give evidence of at least two periods in the past when this disease has broken out. The earliest one is associated with the building of King Solomon's temple, simply proportioned so that "the length thereof was threescore cubits, and the breadth thereof twenty cubits, and the height thereof thirty cubits." The Bible text relates how great stones of 8 and 10 cubits were used for the foundation and "above were costly stones, after the measures of hewed stones, and cedars." Prefabricators will rejoice in verse 7 of I Kings, 6, "And the house, when it was in building, was built of stone made ready before it was brought thither: so that there was neither hammer nor axe nor any tool of iron heard in the house, while it was in building."

Glorious Outcrop of Ancient Greece

The second outbreak of this disease started just a few centuries before the Christian era and culminated in the most perfect of all Grecian temples, the Parthenon. Out of some two hundred and sixty books and articles describing and contesting various theories of how the Parthenon was designed, the true understanding seems to come from one of the earliest of modern modularia victims, architect Ernest Flagg.[1] Flagg demonstrates that at least one dimension of a fundamental rectangle usually coincided with integral standard feet of the Greeks and normal width of bay often contained an even number of feet or of half feet. He admits for Greek temples in general that bays are not always equal nor do fundamental rectangles always agree with integral standard feet but that two facts remain constant, "first, primary proportions for height, breadth, and depth; and second, the employment of units in making plans and buildings."

Modern Revival of Modularia Germ

After it was dormant for another two thousand years, Flagg seems to have revived the germ of modularia and started it propagating itself. Flagg's activity with attractive modular homes and his 1910 book on small houses seems to have been the necessary tonic so that by 1919 the germ was fully recovered and had started reproducing.

Rate of Propagation

Although the germ has never been isolated, circumstantial evidence gives us some knowledge of its characteristics. It seems to be constituted of four cells. The culture which causes the germ to grow is known as gray matter and is found only in the human brain. When properly nourished, the germ will grow to eight cells. When this occurs, the germ subdivides into two four-cell germs. One of these subdivided germs remains with its carrier, but the other seeks a new carrier. It usually leaves the carrier through the mouth or fingertips and finds easiest access to a new victim either through the eye or the ear.

If the first germ division was not released from Flagg's brain until 1919, then there were two germs in 1920, four in 1921, eight in 1922, and sixteen by 1923. From this seemingly slow beginning, by 1933 there were 16,384 germs and in 1943 the number has grown to 16,777,216.

An important factor which undoubtedly affects these theoretical statistics is the fact that many germs get themselves lodged in brains without gray matter and therefore shrivel and die. As long as a single germ is properly cultured on gray matter, however, its victim has understanding and admits the logical reasoning which characterizes modular planning.

Reinfection by the Germ

Persons reinfected by these germs gain more than understanding. They gain an urge to spread the gospel, and their activity seems to bear a complex relation to the number of germs present and the amount of gray matter released for their culture.

Perhaps some future investigator will endeavor to identify the victims and trace their activity. This is subordinate to the objective of all modularia victims, namely, better and more beautiful buildings more efficiently erected by modular methods.

2221 Central Grove Avenue
Toledo, Ohio

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 20, 1943 (Structural Clay Products Division). Received April 20, 1943.

See also H. C. Plummer and E. F. Wanner, "Modular Size of Clay-Products Units," *Jour. Amer. Ceram. Soc.*, **26** [9] 307–20 (1943).

[1] Ernest Flagg, "Basis of Greek Design," *Architecture*, series of articles starting in September, 1930.

AUTUMN MEETING SCHEDULES

Glass Division, Summit Hotel, Uniontown, Pa., September 15 and 16

White Wares and Materials and Equipment Division, Summit Hotel, September 17 and 18

ISCC-NBS COLOR NAMES*

By Dorothy Nickerson†

Abstract

The problem of devising a system of color names "sufficiently standardized to be acceptable and usable by science; sufficiently broad to be used by science, art, and industry; and sufficiently commonplace to be understood, at least in a general way, by the whole public" was proposed to the Inter-Society Color Council in 1931 by the Revision Committee of the U. S. Pharmacopoeia. The ISCC-NBS system of color designations that resulted from the cooperative work of delegates and members of the several member bodies of the Council (The American Ceramic Society is one) is described.

The method adopted is simple in principle: the terms "light," "medium," and "dark" designate increasing degrees of lightness; the adverb "very" is added to extend the scale to "very light" and "very dark"; the adjectives "weak," "medium," "strong," and "vivid" designate increasing degrees of saturation; hue names include pink, red, orange, brown, yellow, olive, green, blue, purple, and their combinations, and neutrals are white, gray, and black. Each color designation defines a block in the three dimensional color solid, the complete ISCC-NBS system providing for 312 such blocks. When more than 312 color designations are necessary, it is recommended that a numerical notation, such as Munsell, be used.

Boundaries for each ISCC-NBS color designation have been carefully specified and reported by the National Bureau of Standards. The 312 designations, and Munsell notations for their central colors, are reported.

Color plays an important role in the ceramic industry. Although solutions to many of its technical color problems can be found within the industry, many others can be best solved by cooperation with other groups that have similar problems. Because this is true, The American Ceramic Society became a member body of the Inter-Society Color Council in 1938, and since then its delegates have taken an important part in Council activities.‡

One of the earliest problems presented by a member body to the Inter-Society Color Council concerned the development of a standard set of color names. This is a problem in which most member bodies are interested, for most of them need or would like to have, as did the Revision Committee of the Pharmacopoeia when they proposed the problem in 1931, a series of color names "sufficiently standardized to be acceptable and usable by science; sufficiently broad to be used by science, art, and industry; and sufficiently commonplace to be understood, at least in a general way, by the whole public."

The ISCC-NBS System of Color Designation that has resulted is due to the cooperative work of Inter-Society Color Council delegates and members. Its widespread use by member bodies will aid in establishing the ISCC-NBS system of naming colors as standard in fact as well as in theory. This report has been prepared so that readers of *The Bulletin* may know what this system of color names is, how it was developed, for what purposes it has already been adopted, and what the central notations are for each name. The information is supplementary to that presented to The American Ceramic Society by Campbell Robertson at the 1941 Annual Meeting.[1(h)]

* Received April 9, 1942. Initials stand for Inter-Society Color Council–National Bureau of Standards.

† Color technologist, Food Distribution Administration, U. S. Department of Agriculture, Washington, D. C., and secretary, Inter-Society Color Council.

‡ American Ceramic Society delegates for 1943–1944 are Isay A. Balinkin, *Chairman;* R. S. Hunter, Campbell Robertson, A. S. Watts, Woldemar A. Weyl, Edward Schramm, H. D. Callahan, W. E. Dougherty, N. J. Kreidl, L. H. Milligan, and V. H. Remington.

[1] (*a*) D. B. Judd and K. L. Kelly, "Scientific Naming of Drugs," *Jour. Amer. Pharmaceutical Assn.*, **27** [3] 208-11 (1938).

(*b*) D. B. Judd, "Inter-Society Color Council Tentative System of Color Names," *Jour. Optical Soc. Amer.*, **29,** 142A (1939); presented before Optical Society of America, October, 1938.

(*c*) D. B. Judd, "Systematic Color Designations for Paper," *Tech. Assn. Papers*, **23,** 512–18 (June, 1940); also in *Paper Trade Jour.*, p. 35 (Oct. 17, 1940); presented before the Technical Association of the Pulp and Paper Industry, February, 1940.

(*d*) Dorothy Nickerson, "Standardization of Color Names, ISCC-NBS Method," *1940 A.S.T.M. Standards on Textile Materials, D–13 Manual; Amer. Dyestuff Rept.*, **29** [16] 392–96 (Aug. 5, 1940); presented before Committee D–13, A.S.T.M., March, 1940.

(*e*) K. L. Kelly, "Instructions for Determining Color Names for Drugs and Chemicals," *Bull. Nat. Form. Comm.*, **8,** 11 (1940); presented before U. S. Pharmacopoeial Convention and National Formulary, February, 1940.

(*f*) H. P. Gage, "Color Theories and the Inter-Society Color Council," *Jour. Soc. Motion Picture Eng.*, **35** (Oct., 1940); presented before the Society of Motion Picture Engineers, April, 1940.

(*g*) D. B. Judd, "Color Systems and Their Interrelation," *Illum. Eng.*, **36** [3] 363–69 (1941); presented before the Illuminating Engineering Society, September, 1940.

(*h*) Campbell Robertson, "Color Standards for Opaque Ceramic Materials," *Bull. Amer. Ceram. Soc.*, **20** [11] 385–86 (1941); presented before The American Ceramic Society, March, 1941.

(*i*) R. M. Evans, "Report on Activities of the Inter-Society Color Council," *Jour. Soc. Motion Picture Eng.*, **37,** 292–306 (Sept., 1941); presented before the spring meeting of the Society of Motion Picture Engineers, 1941.

A 1933 report[2] of the Council's Committee on Measurement and Specification provided the basis which has been followed in developing what is now known as the ISCC-NBS System of Color Designation. Setting boundaries for these color names proved to be the greatest problem, but in 1939 the work was completed at the National Bureau of Standards with the aid of the American Pharmaceutical Association and the U. S. Pharmacopoeial Revision Committee, who for this purpose jointly supported a research associateship at the National Bureau of Standards. The Inter-Society Color Council in 1939 formally approved by letter ballot§ and recommended to the U. S. Pharmacopoeial Revision Committee the method as described in a report by Judd and Kelly.[3]

Very pale (very light, weak)	Very light	Very brilliant (very light, strong)	
Pale (light, weak)	Light	Brilliant (light, strong)	
Weak	Moderate (medium lightness, medium saturation)	Strong	Vivid (very strong)
Dusky (dark, weak)	Dark	Deep (dark, strong)	
Very dusky (very dark, weak)	Very dark	Very deep (very dark, strong)	

FIG. 1.—Relation of adjective modifiers.

The method adopted is simple in principle. The terms "light," "medium," and "dark" designate decreasing degrees of lightness; the adverb "very" is added to extend the lightness scale to "very light" and "very dark." The adjectives "weak," "medium," "strong," and "vivid" designate increasing degrees of saturation. So that no unwieldy adjective combinations shall be required, the following terms have been substituted for certain descriptions: "pale" as a substitute for "light, weak"; "brilliant" as a substitute for "light, strong"; "moderate" as a substitute for "medium, medium"; "dusky" as a substitute for "dark, weak"; and "deep" as a substitute for "dark, strong." The relationship of these adjective modifiers is shown in Fig. 1. These terms are used to modify the following hue or limited hue range names: pink, red, orange, brown, yellow, olive, green, blue, purple, and combinations of these terms formed by using two of them, as in blue-green, or an -ish suffix with one, as in purplish pink. For the neutral series, the terms "white," "gray," and "black" are used.

Certain hue names cover all lightnesses and saturations, e.g., green. Certain other hue names cover only a limited range of lightnesses and saturations, e.g., the pinks which refer to very light reds and the olives which refer to very dark yellows. But common usage is so strong in regard to such terms that the ISCC-NBS method has applied different names to limited ranges of lightnesses and saturations of a single hue. Similarly, colors of yellow-red hue have been designated by three different hue names. The name "brown" is given to the dark group of colors, the term "orange" to those that are light and medium-to-strong in saturation, and the term "orange-pink" to those for light and weak yellow-reds. Each of the terms, "brown," "orange," and "orange-pink," is then divided into several designations by the use of appropriate modifiers selected from those shown in Fig. 1.

The color designations of the ISCC–NBS system define a block in the surface-color solid. The complete system provides for 312 such blocks, a number quite sufficient for many purposes, although it means that *each block contains many distinguishable colors.*

The boundaries of each designation are given in the thirty-four charts included in the Judd-Kelly report.[3] For simplicity and ease of reference, the limits were reported in terms of the Munsell color notations. It may be desirable ultimately to supplement this practical definition of limits for each color designation by giving equivalent definitions in terms of the ICI standard coordinate system adopted in 1931. Meanwhile, interpolation curves made available by the laboratories of the Agricultural Marketing Administration[4] already permit a fairly reliable transfer from Munsell notations to ICI specifications.* This transfer enables the standard ISCC-NBS color name for any color to be found by reference to the ICI, or the Munsell system directly, through the use of these published conversion tables.

TABLE I

ABBREVIATIONS FOR USE WITH ISCC-NBS SYSTEM OF DESIGNATING COLORS

Hue			
Noun form	Adjective form	Adjective modifiers	
Pk pink	pk pinkish	lt light	
R red	r reddish	dk dark	
O orange	o orange	wk weak	
Br brown	br brownish	str strong	
Y yellow	y yellowish	mod moderate	
Ol olive	ol olive	med medium	
G green	g greenish	viv vivid	
B blue	b bluish		
P purple	p purplish		
Wh white			
		Adverb modifier	
Gr gray			
Bk black		v very	

[2] Report of Committee on Measurement and Specification, I. H. Godlove (chairman), Minutes of 1932 Annual Meeting, Inter-Society Color Council News Letter No. 4.

§ Out of 27 votes received (33 possible), 26 were for adoption. Except for one association and one ballot marked "not voting," there were at least 2 affirmative votes (out of a possible 3) from each association represented in the Council at the time the vote was taken. There were no negative votes.

[3] D. B. Judd and K. L. Kelly, "Method of Designating Colors," *Jour. Research Nat. Bur. Standards*, **23** [3] 355–85 (Sept., 1939); R.P. 1239; *Ceram. Abs.*, **19** [4] 85 (1940).

[4] Dorothy Nickerson, "Use of ICI Tristimulus Values in Disk Colorimetry." Mimeographed preliminary report, 1938; also supplement, U. S. Dept. of Agriculture, December, 1941.

* Since this report was prepared for *The Bulletin*, a final report has been made by the subcommittee of the Optical Society of America on Smoothing the Munsell Colors. This final report, which was published in the July, 1943, issue of the *Journal of the Optical Society*, makes it possible to have completely reliable transfers between ICI specification and Munsell notation.

Because abbreviations probably will be used more often than not for the ISCC-NBS color designations, a notation for recording them is given in Table I. Capital letters refer to the noun form of the hue name; lower-case letters are used for the adjective form. As blue, brown, and black all begin with B, they are distinguished by writing the abbreviation B for blue, Br for brown, and Bk for black. Green and gray are distinguished by using G for green and Gr for gray. Orange and olive are distinguished by using O for orange and Ol for olive.

The method of designation has been described before a number of the associations that are member bodies of the Inter-Society Color Council,[1] and subcommittees of the Council have continued to work on various problems connected with the adoption of these color designations for, although they were officially adopted only for use with drugs and chemicals, other applications are being studied with the expectation that they will be adopted for more general use. The ISCC-NBS color designations are already being used in the new edition of the National Formulary and U. S. Pharmacopoeia, but it will be several years before changes are made in all the monographs, as the work of measuring all the drugs and chemicals named in them is considerable. The recently adopted American War Standard for the Specification and Description of Color (ASA–Z44–1942) includes ISCC-NBS names as Provision 4 (Provision 1, spectrophotometric specification; Provision 2, ICI specification; Provision 3, Munsell notation).

Early in 1941, a committee on the specification and production of central colors for the ISCC-NBS color designations was appointed by the Inter-Society Color Council. Its first problem was to obtain central notations for the color names for which boundaries had been set by Judd and Kelly, for not until these central notations are known can charts be made up to illustrate the ISCC-NBS system of names. Although these names are gradually coming into use, such use is not likely to be widespread until charts are available to illustrate them. Each central notation represents the approximate center of the corresponding block in the color solid. Although some of these blocks are irregular in form, they can nearly always be divided into regular slabs. A central notation can therefore be secured quite readily by making average determinations of hue, chroma, and value, weighted in accordance with the corresponding slabs.[6]

Table II lists Munsell notations for the ISCC-NBS central colors. These notations have already been used in preparing color charts for specifying soil colors according to the ISCC-NBS system of names.[7]

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[5] Summary of Committee Reports, Minutes of Tenth Annual Meeting, ISCC, p. 9 (March, 1941); Minutes of Eleventh Annual Meeting, ISCC, p. 9 (1942). Members of the Committee are Blanche R. Bellamy, Carl E. Foss, Walter C. Granville, S. M. Newhall, and Dorothy Nickerson, Chairman.

[6] Dorothy Nickerson and Sidney M. Newhall, "Central Notations for ISCC-NBS Color Names," *Jour. Optical Soc. Amer.*, **36**, 587–91 (1941).

[7] T. D. Rice, Dorothy Nickerson, A. M. O'Neal, and James Thorp, "Preliminary Color Standards and Color Names for Soils," *U. S. Dept. Agriculture Misc. Pub.*, No. 425 (Sept., 1941).

TABLE II

MUNSELL NOTATIONS FOR CENTRAL COLORS OF ISCC-NBS COLOR NAMES

Name	Munsell notation of central color	
Pinks and reds		
Pinkish white	6.5R	9.0/1.0
Pinkish gray	6.5R	7.5/1.0
Reddish gray	8.5R	5.5/1.0
Dark reddish gray	7.5R	3.5/1.0
Reddish black	7.5R	1.5/1.0
Pale purplish pink	4.5RP	8.7/3.0
Light purplish pink	4.5RP	8.5/7.0
Brilliant purplish pink	4.5RP	8.5/11.0
Weak purplish pink	4.5RP	7.0/3.0
Moderate purplish pink	4.5RP	7.0/7.0
Strong purplish pink	4.5RP	7.0/11.0
Pale pink	2.0R	8.7/2.8
Light pink	3.0R	8.7/6.2
Brilliant pink	0.5R	8.5/11.0
Weak pink	3.5R	7.3/2.5
Moderate pink	4.5R	7.3/5.7
Strong pink	4.5R	7.8/9.7
Vivid pink	6.0R	8.2/13.0
Pale orange pink	2.5YR	9.0/2.0
Light orange pink	2.0YR	9.0/4.8
Weak orange pink	2.5YR	7.5/2.0
Moderate orange pink	2.0YR	7.5/4.8
Strong orange pink	1.5YR	8.5/9.0
Pale purplish red	0.5R	6.0/4.0
Light purplish red	0.5R	6.0/8.0
Brilliant purplish red	0.5R	6.0/12.0
Weak purplish red	0.5R	4.5/4.0
Moderate purplish red	0.5R	4.5/7.0
Strong purplish red	0.5R	4.5/11.0
Vivid purplish red	0.5R	4.5/14.0
Dusky purplish red	0.5R	3.0/4.0
Dark purplish red	0.5R	3.0/7.0
Deep purplish red	0.5R	3.0/11.0

Name	Munsell notation of central color	
Pinks and reds (continued)		
Very dusky purplish red	0.5R	1.5/4.0
Very dark purplish red	0.5R	1.5/7.0
Very deep purplish red	0.5R	1.5/11.0
Pale red	8.5R	6.0/2.7
Light red	5.0R	6.0/8.0
Brilliant red	5.0R	6.0/12.0
Weak red	8.5R	4.5/2.7
Moderate red	5.0R	4.5/7.0
Strong red	5.0R	4.5/11.0
Vivid red	5.0R	4.5/14.0
Dusky red	8.5R	3.0/2.6
Dark red	5.0R	3.0/7.0
Deep red	5.0R	2.5/11.0
Very dusky red	8.5R	1.5/2.6
Very dark red	5.0R	1.5/7.0
Oranges and browns		
Light brownish gray	8.5YR	5.5/1.0
Brownish gray	7.5YR	3.5/1.0
Brownish black	7.5YR	1.5/1.0
Light reddish orange	9.0R	7.0/9.0
Brilliant reddish orange	9.0R	7.0/13.0
Weak reddish orange	9.5R	5.7/5.5
Moderate reddish orange	9.0R	5.5/9.0
Strong reddish orange	9.0R	5.5/13.0
Vivid reddish orange	9.0R	5.5/16.0
Dark reddish orange	9.0R	4.0/10.0
Deep reddish orange	9.0R	4.0/13.0
Very pale orange	9.0YR	8.5/2.0
Pale orange	6.5YR	8.5/5.0
Light orange	5.5YR	8.5/9.0
Brilliant orange	5.5YR	8.5/13.0
Weak orange	5.5YR	6.6/5.4

TABLE II (*continued*)

Name	Munsell notation of central color
Oranges and browns (continued)	
Moderate orange	4.5YR 6.5/9.0
Strong orange	4.5YR 6.5/13.0
Vivid orange	4.5YR 6.2/16.0
Dark orange	4.5YR 5.0/9.0
Deep orange	4.5YR 5.0/13.0
Pale yellowish orange	0.5Y 9.0/5.1
Light yellowish orange	10.0YR 9.0/9.0
Brilliant yellowish orange	10.0YR 9.0/13.0
Weak yellowish orange	0.5Y 7.5/5.1
Moderate yellowish orange	10.0YR 7.5/9.0
Strong yellowish orange	10.0YR 7.5/13.0
Vivid yellowish orange	10.0YR 7.5/16.0
Dusky yellowish orange	10.0YR 6.0/6.0
Dark yellowish orange	10.0YR 6.0/9.0
Deep yellowish orange	10.0YR 6.0/13.0
Pale reddish brown	1.5YR 5.0/4.0
Weak reddish brown	1.5YR 3.5/4.0
Moderate reddish brown	9.0R 3.5/7.0
Strong reddish brown	9.0R 3.0/11.0
Dusky reddish brown	1.5YR 1.5/4.0
Dark reddish brown	9.0R 1.5/7.0
Deep reddish brown	9.0R 1.5/11.0
Very pale brown	9.0YR 7.0/2.0
Pale brown	8.5YR 5.5/2.0
Light brown	5.0YR 5.3/5.0
Weak brown	8.5YR 3.5/2.0
Moderate brown	5.0YR 3.5/5.0
Strong brown	4.5YR 3.5/9.0
Dusky brown	8.5YR 1.5/2.0
Dark brown	5.0YR 1.5/5.0
Deep brown	4.5YR 1.5/9.0
Light yellowish brown	1.0Y 6.0/4.0
Moderate yellowish brown	10.0YR 4.5/5.2
Strong yellowish brown	10.0YR 4.5/9.0
Dark yellowish brown	10.0YR 2.5/5.2
Deep yellowish brown	10.0YR 2.5/9.0
Light olive brown	4.0Y 5.0/5.0
Moderate olive brown	4.0Y 3.5/5.0
Dark olive brown	4.0Y 1.5/5.0
Yellows and olives	
Yellowish white	7.5Y 9.0/1.1
Yellowish gray	7.5Y 7.5/1.1
Light olive gray	9.5Y 5.5/1.1
Olive gray	9.5Y 3.5/1.1
Olive black	9.5Y 1.5/1.1
Pale yellow	5.5Y 9.0/3.3
Light yellow	4.5Y 9.0/7.0
Brilliant yellow	4.5Y 9.0/11.0
Weak yellow	5.5Y 7.5/3.3
Moderate yellow	4.5Y 7.5/7.0
Strong yellow	4.5Y 7.5/11.0
Vivid yellow	4.5Y 7.5/14.0
Dusky yellow	5.0Y 6.0/4.0
Dark yellow	4.5Y 6.0/7.0
Deep yellow	4.5Y 6.0/11.0
Pale greenish yellow	9.0Y 9.0/4.0
Light greenish yellow	9.0Y 9.0/7.0
Brilliant greenish yellow	9.0Y 9.0/11.0
Weak greenish yellow	9.0Y 7.5/4.0
Moderate greenish yellow	9.0Y 7.5/7.0
Strong greenish yellow	9.0Y 7.5/11.0
Vivid greenish yellow	9.0Y 7.5/14.0
Dusky greenish yellow	9.0Y 6.0/4.0
Dark greenish yellow	9.0Y 6.0/7.0
Deep greenish yellow	9.0Y 6.0/11.0
Pale olive	6.0Y 5.5/2.5
Light olive	8.5Y 5.0/5.0
Weak olive	6.0Y 3.5/2.5
Moderate olive	8.5Y 3.5/5.0
Dusky olive	6.0Y 1.5/2.5
Dark olive	8.5Y 1.5/5.0
Greens	
Greenish white	5.5G 9.0/1.0
Light greenish gray	5.5G 7.5/1.0
Medium greenish gray	5.5G 5.5/1.0

Name	Munsell notation of central color
Greens (continued)	
Dark greenish gray	5.5G 3.5/1.0
Greenish black	5.5G 1.5/1.0
Weak olive green	4.0GY 3.5/2.0
Moderate olive green	4.0GY 3.3/4.7
Strong olive green	4.0GY 3.0/9.0
Dusky olive green	4.0GY 1.5/2.0
Dark olive green	4.0GY 1.5/5.0
Deep olive green	4.0GY 1.5/9.0
Pale yellow green	4.0GY 8.5/2.5
Light yellow green	4.0GY 8.5/7.0
Brilliant yellow green	4.0GY 8.5/11.0
Weak yellow green	4.0GY 6.5/2.5
Moderate yellow green	4.0GY 6.5/7.0
Strong yellow green	4.0GY 6.5/11.0
Vivid yellow green	4.0GY 6.5/14.0
Dusky yellow green	4.0GY 5.0/2.5
Dark yellow green	4.0GY 4.5/7.0
Deep yellow green	4.0GY 4.5/11.0
Very pale yellowish green	9.5GY 9.0/4.0
Very light yellowish green	9.5GY 9.0/7.0
Pale yellowish green	9.5GY 7.5/4.0
Light yellowish green	9.5GY 7.5/7.0
Brilliant yellowish green	9.5GY 7.5/11.0
Weak yellowish green	9.5GY 5.5/4.0
Moderate yellowish green	9.5GY 5.5/7.0
Strong yellowish green	9.5GY 5.5/11.0
Vivid yellowish green	9.5GY 6.5/14.0
Dark yellowish green	9.5GY 4.0/5.0
Deep yellowish green	9.5GY 4.0/9.0
Very dark yellowish green	9.5GY 2.5/5.0
Very deep yellowish green	9.5GY 2.5/9.0
Very pale green	2.5G 8.5/2.0
Very light green	5.5G 8.5/5.2
Very brilliant green	6.0G 8.5/9.0
Pale green	2.5G 6.5/2.0
Light green	5.5G 6.5/5.2
Brilliant green	6.0G 6.5/9.0
Weak green	2.5G 4.5/2.0
Moderate green	5.5G 4.5/5.2
Strong green	6.0G 4.5/9.0
Vivid green	6.0G 5.5/12.0
Dusky green	6.0G 3.0/2.0
Dark green	5.5G 3.0/5.2
Deep green	6.0G 2.5/9.0
Very dusky green	6.0G 1.5/2.0
Very dark green	5.5G 1.5/5.2
Very light bluish green	10.0G 8.5/4.8
Light bluish green	10.0G 6.5/4.8
Brilliant bluish green	1.0BG 7.2/9.0
Moderate bluish green	10.0G 4.5/4.8
Strong bluish green	1.0BG 4.5/9.0
Vivid bluish green	1.0BG 4.5/12.0
Dark bluish green	10.0G 3.0/4.8
Deep bluish green	1.0BG 2.5/9.0
Very dark bluish green	10.0G 1.5/4.8
Very pale blue green	2.0BG 8.5/2.0
Very light blue green	5.5BG 8.5/5.0
Pale blue green	2.0BG 6.5/2.0
Light blue green	5.5BG 6.5/5.0
Brilliant blue green	5.5BG 7.0/9.0
Weak blue green	2.0BG 4.5/2.0
Moderate blue green	5.5BG 4.5/5.0
Strong blue green	5.5BG 4.5/9.0
Vivid blue green	5.5BG 4.5/12.0
Dusky blue green	8.0BG 3.0/2.0
Dark blue green	5.5BG 3.0/5.0
Deep blue green	5.5BG 2.5/9.0
Very dusky blue green	8.0BG 1.5/2.0
Very dark blue green	5.5BG 1.5/5.0
Blues	
Bluish white	6.0B 9.0/1.0
Light bluish gray	6.0B 7.5/1.0
Medium bluish gray	6.0B 5.5/1.0
Dark bluish gray	6.0B 3.5/1.0

TABLE II (*continued*)

Name	Munsell notation of central color	
Blues (continued)		
Bluish black	6.0B	1.5/1.0
Very light greenish blue	1.0B	8.5/5.0
Light greenish blue	1.0B	6.5/5.0
Brilliant greenish blue	1.0B	7.0/9.0
Moderate greenish blue	1.0B	4.5/5.0
Strong greenish blue	1.0B	4.5/9.0
Vivid greenish blue	1.0B	4.5/12.0
Dark greenish blue	1.0B	3.0/5.0
Deep greenish blue	1.0B	2.5/9.0
Very dark greenish blue	1.0B	1.5/5.0
Very pale blue	6.5B	8.5/2.9
Very light blue	8.5B	8.5/7.0
Very brilliant blue	8.5B	8.5/11.0
Pale blue	6.5B	6.5/2.9
Light blue	8.5B	6.5/7.0
Brilliant blue	8.5B	6.5/11.0
Weak blue	6.5B	4.5/2.9
Moderate blue	8.5B	4.5/7.0
Strong blue	8.5B	4.5/11.0
Vivid blue	8.5B	4.5/14.0
[illegible] blue	8.0B	2.5/3.1
[illegible]lue	8.5B	2.5/7.0
Deep blue	8.5B	2.5/11.0
Very pale purplish blue	6.0PB	8.0/2.6
Very light purplish blue	5.5PB	7.5/7.0
Very brilliant purplish blue	5.5PB	7.5/11.0
Pale purplish blue	6.0PB	5.5/2.6
Light purplish blue	5.5PB	5.5/7.0
Brilliant purplish blue	5.5PB	5.5/11.0
Weak purplish blue	6.0PB	3.5/2.6
Moderate purplish blue	5.5PB	3.5/7.0
Strong purplish blue	5.5PB	3.5/11.0
Vivid purplish blue	5.5PB	4.5/15.0
Dusky purplish blue	6.0PB	1.5/2.6
Dark purplish blue	5.5PB	1.5/7.0
Deep purplish blue	5.5PB	1.5/11 0
Purples		
Purplish white	6.0P	9.0/1.0
Light purplish gray	6.0P	7.5/1.0
Medium purplish gray	0.5RP	5.5/1.0
Dark purplish gray	0.5RP	3.5/1.0
Purplish black	0.5RP	1.5/1.0
Very pale bluish purple	10.0PB	8.0/4.0
Very light bluish purple	10.0PB	7.7/7.0
Very brilliant bluish purple	10.0PB	7.5/11.0
Pale bluish purple	10.0PB	5.5/4.0
Light bluish purple	10.0PB	5.5/7.0
Brilliant bluish purple	10.0PB	5.5/11.0
Weak bluish purple	10.0PB	3.5/4.0
Moderate bluish purple	10.0PB	3.5/7.0
Strong bluish purple	10.0PB	3.5/11.0
Vivid bluish purple	10.0PB	4.5/14.0
Dusky bluish purple	10.0PB	1.5/4.0
Dark bluish purple	10.0PB	1.5/7.0
Deep bluish purple	10.0PB	1.5/11.0
Very pale purple	5.5P	8.5/2.6
Very light purple	5.0P	8.5/7.0
Pale purple	5.5P	6.5/2.6
Light purple	5.0P	6.5/7.0
Brilliant purple	5.0P	6.5/11.0
Weak purple	5.5P	4.5/2.6
Moderate purple	5.0P	4.5/7.0
Strong purple	5.0P	4.5/11.0
Vivid purple	5.0P	4.5/14.0

Name	Munsell notation of central color	
Purples (continued)		
Dusky purple	5.5P	3.0/2.6
Dark purple	5.0P	3.0/7.0
Deep purple	5.0P	3.0/11.0
Very dusky purple	5.5P	1.5/2.6
Very dark purple	5.0P	1.5/7.0
Very deep purple	5.0P	1.5/11.0
Very pale reddish purple	9.5P	8.5/4.0
Very light reddish purple	9.5P	8.5/7.0
Pale reddish purple	9.5P	6.5/4.0
Light reddish purple	9.5P	6.5/7.0
Brilliant reddish purple	9.5P	6.5/11.0
Weak reddish purple	9.5P	4.5/4.0
Moderate reddish purple	9.5P	4.5/7.0
Strong reddish purple	9.5P	4.5/11.0
Vivid reddish purple	9.5P	4.5/14.0
Dusky reddish purple	9.5P	3.0/4.0
Dark reddish purple	9.5P	3.0/7.0
Deep reddish purple	9.5P	3.0/11.0
Very dusky reddish purple	9.5P	1.5/4.0
Very dark reddish purple	9.5P	1.5/7.0
Very deep reddish purple	9.5P	1.5/11.0
Pale red purple	6.5RP	6.0/2.7
Light red purple	4.5RP	6.0/8.0
Brilliant red purple	4.5RP	6.0/12.0
Weak red purple	6.5RP	4.5/2.7
Moderate red purple	4.5RP	4.5/7.0
Strong red purple	4.5RP	4.5/10.0
Vivid red purple	4.5RP	4.0/14.0
Dusky red purple	6.5RP	3.0/2.7
Dark red purple	4.5RP	3.0/7.0
Deep red purple	4.5RP	3.0/11.0
Very dusky red purple	6.5RP	1.5/2.7
Very dark red purple	4.5RP	1.5/7.0
Very deep red purple	4.5RP	1.5/11.0
Grays and near grays		
White	N	9.2/
Light gray	N	7.5/
Medium gray	N	5.5/
Dark gray	N	3.5/
Black	N	1.3/
Pinkish white	6.5R	9.0/1.0
Pinkish gray	6.5R	7.5/1.0
Reddish gray	8.5R	5.5/1.0
Dark reddish gray	7.5R	3.5/1.0
Reddish black	7.5R	1.5/1.0
Light brownish gray	8.5YR	5.5/1.0
Brownish gray	7.5YR	3.5/1.0
Brownish black	7.5YR	1.5/1.0
Yellowish white	7.5Y	9.0/1.1
Yellowish gray	7.5Y	7.5/1.1
Light olive gray	9.5Y	5.5/1.1
Olive gray	9.5Y	3.5/1.1
Olive black	9.5Y	1.5/1.1
Greenish white	5.5G	9.0/1.0
Light greenish gray	5.5G	7.5/1.0
Medium greenish gray	5.5G	5.5/1.0
Dark greenish gray	5.5G	3.5/1.0
Greenish black	5.5G	1.5/1.0
Bluish white	6.0B	9.0/1.0
Light bluish gray	6.0B	7.5/1.0
Medium bluish gray	6.0B	5.5/1.0
Dark bluish gray	6.0B	3.5/1.0
Bluish black	6.0B	1.5/1.0
Purplish white	6.0P	9.0/1.0
Light purplish gray	6.0P	7.5/1.0
Medium purplish gray	0.5RP	5.5/1.0
Dark purplish gray	0.5RP	3.5/1.0
Purplish black	0.5RP	1.5/1.0

Will Americans Give up Their Free Enterprise?

Will They Submit to Government Control in Patentable Discoveries and Developments?

Should Our Research Laboratories, National, State, University, Institute, and Industrial, Be Subject to Governmental Bureaucratic Control?

If Your Answers Are "No," Say So to Your Senators and Congressmen in Protest of That Kilgore Bill.

DISHES AND DINING*

By Carlton Atherton

Abstract

A discussion is presented of a plausible and fascinating idea, namely, that the social custom of dining stems from the development of ceramics. At least some part of our etiquette and eating amenities are an outgrowth of progress in the ceramic industry.

I. Origin of the Culinary Art

Man was created hungry and being hungry he found food and ate. No reason was involved. It was simply the satisfying of a natural craving. (This was ages before the development of our indigestion remedies.) Man ate his food alone and furtively in some place of security, hoping to be undiscovered by a stronger and hungrier fellow. A long time elapsed before the custom of eating in groups became common. Then only when individuals knew about each other and about the food supply was there assurance enough to settle down together. When group eating developed, table manners made their first appearance (not, to be sure, as we know them) and have ever since been waging a battle with man's brute nature.

Primitive man ate, when he could, to satisfy his ever-gnawing hunger. This required no more reason than lying down to sleep, but to snare beasts, birds, and fish, to cultivate plants and domesticate animals, and finally to store foodstuffs for future use required a reasoning power which came slowly and only after long ages of development.

Our early ancestors did not prepare their food any more than the animals do now. They ate nuts, berries, fruits, eggs, fish, birds, and any game they could kill or get by plunder. They were hungry and ate whatever they could whenever they could—and uncooked until fire was discovered.

Eating, then, knows no other origin than the satisfaction of hunger. Eating habits, however, have been molded by countless external influences, one of the chief of which was the discovery and development of pottery.

Although baskets, which allowed the storage of dry foodstuffs, were made before pottery, it was not until man had clay pots that he developed cooking. Previously, he had come to roast meats and heat liquids by throwing hot stones into pitch-lined baskets, but it was the clay vessel which gave birth to culinary art. Man could now cook and store food in great jars to guard against periods of scarcity and famine.

Primitive man built his fire in the center of a cave. When he learned to construct a rude shelter, the fire was made indoors, and there it occupied the center of the house for centuries. Doors were made in two sections so that the upper part could be opened to allow the smoke to escape, while the lower half was closed to keep out wandering animals. The fire later was moved to one side, and a hole was cut in the roof. About the twelfth century, a primitive flue came into use in northern Europe, but it was not until the fifteenth century that an architectural form of the flue was developed. Brick and tile stoves were constructed to be followed by brick-lined iron stoves which were more flexible and gave greater leeway to the cook. The open fireplace with its cranes, spits, and side ovens remained in rustic homes, however, for centuries after the great houses and palaces acquired stoves.

Refinement of taste was a much later development. Early man, although he ate great quantities, had little of the discrimination which we associate with good eating. Food was not seasoned or enhanced with sauces to please the palate until man had acquired a discerning taste.

With increased leisure and culture, the appetite was pampered and by the time of the Greeks, man ate to please his palate as much as to satisfy his hunger. Sumptuous feasts were held at which countless delicacies were served in earthenware vessels made to imitate the forms of Homeric bronzes. It was during this time that the renowned epicures lived, Hegemon, Numenius, and the great Epicurus himself.

As with everything else, the Romans emulated Greek culinary art, but in their zeal they emphasized luxury, added extravagance, and lost subtlety.

The birthplace of modern cookery was in Renaissance Italy. It was natural that with the rebirth of the various phases of art an interest in cooking should awaken after a long slumber through the Dark Ages. Italy undoubtedly led all of Europe in the development of fine food.

At this time, a powerful renewed interest in pottery was shown, with a consequent rise in production. Such great quantities of the ware from Faenza were distributed throughout Europe that the word "faience" became synonymous with earthenware. The potters were tremendously influenced by the Hispano-Moresque ware brought in on Majorcan trading ships and began to reproduce it. Even at the outset, these imitations had a national flavor. Soon the Italian potters were making some of the finest earthenware ever produced in Europe. With a greater advance in technical skill, they began to make auspicious saltcellars and epergnes to grace the tables of the great palaces. They made unique dishes as gifts from one family to another and small bowls and plates to be given as love tokens. These dishes required special foods, and the great chefs, not to be outdone by the potters, produced them.

Francis I looked on with a covetous eye and brought both potters and chefs from Italy to produce fine foods and the ware in which to serve them in the great chateaux he was building in the valley of the Loire. His Italian daughter-in-law, Catherine d'Medici, continued to bring Florentine customs to the French court when she seized the power of her sons' throne at the death of Henry II. And in England, jovial rollicking Henry VIII, not to be outdone

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by his French rival, brought to the English table great banquets formerly unknown.

II. Advent of Table Etiquette

Table manners belong to an advanced stage in man's development. When man ate alone there was no need for any kind of etiquette. But in group eating, consideration became necessary. With the advance in culinary art, especially in the last three centuries, table etiquette developed in the social scheme.

To Americans, the table manners at the French and English courts of a few hundred years ago would seem uncouth. Meats were cut by the carver, passed on the knife, and deposited on the table before each person, whose only implements were his fingers. Soft foods were eaten with a spoon from a common dish called the messe, trencher, or treen. The spoons were not furnished by the host. Each guest brought his own. In the time of Chaucer it was considered indelicate to dip into the messe more than twice without wiping the spoon on the tablecloth.

It was then necessary for the diners to wash their hands during the meal. Great basins were passed by servants who carried towels for the guests. Individual finger bowls as we know them appeared first in Italy during the fifteenth century. At first made of precious metals, they were soon made of pottery. Some bowls exquisitely wrought in soft paste porcelain were made for the tables of the Medici.

The fork was unknown in the court of Louis XIV and was not used in England until it was introduced from Italy during the reign of James I. Even at that time, its use was considered to be pure affectation.

In the time of Louis XIV, there was a great advance in cooking. The potteries of France by this time were producing ware superior to that of Italy. The potters themselves were constantly contriving fanciful conceits for the princely tables, and the chefs, not to be outdone, concocted specialties for the astonishment and amazement of all. These specialties became so complicated that small tickets called "etiquettes" were sometimes attached to them to explain what part of the intricate structure was to be eaten and to distinguish food from decoration.

By this time, a platter or tray was placed before each person under his plate to protect the elaborate cloths of velvet and silk damask. It was from this custom that our place plates developed.

III. Effect of Chinese Porcelain on European Pottery

When the Dutch and Portuguese trading vessels began to carry Chinese porcelains into Europe, a new phase of dining appeared. All of the crowned heads of Europe set their potters to work to discover the secret of this ware.

In Germany, France, and Italy soft paste porcelain was the first result. Many elaborate table garnitures, saltcellars, and shiplike nefs appeared, together with ornately decorated plates.

In 1710, Böttger discovered how to make true porcelain, and the more costly soft paste was abandoned. Germany and France led Europe in the production of this new ware. Unfortunately, the Chinese porcelains imported were for the great part of a decadent nature. These forms and decorations were simply a springboard for the potters of 18th century Europe with its luxurious and artificial court life. The skill achieved by the potters of Meissen and Sèvres is a matter for wonder. These potters worked for the excitement and pleasure of jaded courts. The nature of the materials they used were ridden over roughshod, and clay was forced into intricacies of form and decoration logical only for precious metals. In fact, the potters consciously strove to outdo the jewelers of the time in splendor and elaboration.

The English potters in striving to make porcelain hit upon a body which lies between the hard and the soft paste of the continent; calcined bone was used in the mix. This body was so satisfactory that they did not abandon it when the secrets of the Chinese became known. True porcelain in England was short-lived.

The custom of tea-drinking was introduced into Europe together with porcelain from China. This beverage was adopted immediately in England, but the French preferred their coffee to this new insipid drink. Some of the Chinese ritual accompanied the tea-drinking to England. In China, tea was served in small bowls which were potted heavily enough to be cupped in two hands and raised to the lips. There was a friendliness in this that was lost in France where the coffee cups were of egg-shell thinness and required handles. The English emulated the Chinese and made their cups without handles. This custom was so strong that it continued even when the cups were more thinly potted, so it became customary to pour the tea into the saucer for cooling. To prevent spotting the furniture or tablecloths, small dishes were made for the cups called cup plates.

Fine porcelain ware was restricted to the tables of the wealthy classes because of its cost. The poorer people used dishes of wood or pewter and sometimes heavy earthenware until the middle of the eighteenth century. It was then that Josiah Wedgwood made revolutionary changes in the ceramic industry. He improved the wheel, constructed better kilns, introduced the turning lathe, improved the clays and glazes, and invented a pyrometer, to name only a few of his achievements. His greatest contribution was to provide good simple ware cheaply enough to be purchased by the people at large. The shapes of this ware were practical, "lids fit well, spouts did their work without spilling, bases gave safety from overturning; everywhere there was efficiency and economy of means."

Since Wedgwood's time, tableware has followed his general pattern. Any divergence has been more or less in the application of ornament, many times with saddening results. It would be wise if we looked into the dualism of the work of Josiah Wedgwood. "On the one hand we have the potter relying on his own knowledge of the craft and designing for use; on the other hand, we have the potter relying for his design on the outside artist, who is not concerned to design for use so much as for ornament, as an exhibition of his artistic skill."

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WE ARE RUGGED AMERICANS

TO THINK AND TALK*

For some obscure reason, the professional engineering societies have followed an idea that our societies in their meetings, reports, and publications should not express their views on the political management of public affairs or on other controversial matters.

Too many engineers forget they rate in the intelligentsia and that their analyses and opinions of public affairs would be a distinct service to the general public, the planners, the legislators, and public officials.

To express opinions for or against governmental policies and operations, whether local, state, or national, does not mean you have detracted from our professional ideals. There is nothing in the ethics of the profession which says that you as an engineer cease to be an engineer because you publicly disagree with the policies and actions of any political administration in power.

It is a constitutional right of every citizen to argue the portents of proposed legislation and the management of public affairs, and just because a person joins an engineering society it should not be deemed he has relinquished that right. To argue, does not mean the society becomes a political organization. Rather it becomes a sounding board for the mature opinions of engineers which may be of inestimable value to the public.

Unquestionably the technological professions appreciably determine the trends of mankind in its forward march toward universal civilization. Laws are made to govern these trends, and so far, our profession has had very little to do with the formulation of laws and policies for the promotion and management of these trends.

This lack of effort to assist in guiding governmental policies which affect and control the lives of our people is a really serious reflection on the technological professions, and their members fail in their duty as real Americans if they persist in adhering to such a policy.

The American Association of Engineers in its publication, the *Professional Engineer*, has clearly and boldly analyzed U. S. Senate Bill 702 (The Kilgore Bill). The analysis plainly shows that the alleged purpose of the bill "to mobilize the scientific and technical resources of the Nation" would be inimical to the best interests of the people and the profession.

Enlightened and practical criticism of the Bill as drafted will cause necessary revisions and amendments to the end that a final bill, if enacted into law, may serve a real useful purpose. Without the criticism of the engineering profession the Bill might have been passed in its original form and become a detriment to technological progress.

The legal and medical professions take prompt action when pertinent legislation is introduced in State legislatures or the national Congress which they believe is not for the best interest of the public.

Public opinion as expressed in the news has been insistent that legislation be passed to control labor unions in their private and public relations. The principles of sound labor legislation have been approved in engineering circles for many years, and the expressions of engineers, in some small part, may have assisted in the recent enactment of measures to accomplish this worth-while purpose.

Some years ago, when many little piggies were killed and marginal farm crops were ploughed under, most engineers deplored the idea, and time has proved that they were right. Presently some economists argue there is no reason why the Federal debt (now at about 150 billion which is equal to the assessed valuation of all taxable real property in the United States, and which debt may reach 300 to 400 billions before the war is over) should ever be paid if our national income is on the increase from year to year. Being thinking people, it is doubtful that many engineers will subscribe to this idea, and therefore it is most important and a real obligation that the voice of the engineer shall be heard on the formulation of national financial policies.

The National Resources Planning Board has indicated its full concurrence with its committee in regard to the necessity for a public aid system geared to a program for high national income and full employment.

The program is fine and almost everyone will agree; but then the Board states, "We have passed the state when *financing* the program need be more than a technical problem. If we measure the physical and intellectual stature of our people and our vast national resources, financial problems need be no hindrance."

It can be inferred from this statement that the Administration's philosophy of deficit spending and subsidies shall be adopted as a fixed plan for future Federal financing. The point is worthy of serious consideration, as individuals, business concerns, cities, counties, and states do not advocate, nor live and prosper, by such means.

No matter what political party or administration is in power when such "economic" ideas are propounded it is the engineer's right and duty as an American citizen to express his opinions for or against such measures, and one of the best media for circulating his thoughts is through his engineering society.

Our opinions are highly regarded and respected by people in all walks of life, and it is our bounden duty as a learned profession to speak when the occasion demands, in order that we may help preserve for all of our people a sound and equitable national economy.

—ARTHUR RICHARDS, *President, American Association of Engineers*

* Reprinted from *Professional Engineer*, **28** [2] 24–25 (June, 1943). See also *Bull. Amer. Ceram. Soc.*, **22** [8] 288–90 (1943).

PRIVATE ENTERPRISE*

BY BENJAMIN DE CASSERES

"I am the spirit of private enterprise.

Wherever I have existed freedom of mind and body have existed.

Wherever I have been murdered by collectivist laws and government stangulation, freedom of mind and freedom of body have died.

I was the physical lever of Athenian civilization.

I died in the collectivist Feudal ages.

I was resurrected in the Renaissance, beginning the modern age.

With the rebirth of free private trading came the vastest expansion in the arts and sciences the world has ever known.

I, *Private Enterprise*, have brought men of the same countries and men of distant countries closer together in friendlier intercourse than all the socialistic and communistic doctrines combined.

My trade routes have been the routes of human progress.

I am the expression and sustainer of all that is lordly in the human soul—*Self-Reliance*, the *Adventurous Spirit*, emotional and mental *Initiative*, *Ambition*, and *Inventive Resourcefulness*.

With my rebirth in the Renaissance the human lever of living began to rise.

The shackles of slave labor began to rust and crack.

Money became international.

Man at my touch took on something of the aspect of a creative god.

I, *Private Enterprise*, built America.

If she is a giant today in production it is I who made her a giant.

* Reprinted from *Columbus Rotary Club Bulletin*, August 16, 1943.

I cleared her forests.
I built her railroads.
I tunneled her mountains.
I erected her factories, dug the coal and ore in her mines, and set out her Ships on the Seven Seas.
In my brain was born every creative comfort you enjoy.
I, *Private Enterprise*, with my unshackled captains of industry, built the muskets, the airplanes, the tanks, the submarines, the great guns that were used in the Revolutionary, Civil, and World War No. 1 and that are now protecting the United States from invasion.
I am the hope of Europe and Asia.
I, *Private Enterprise*, am the working classes, the middle classes, and the well-to-do classes.
I am the butcher shop, the bank, the newsstand, the great department store, the giant furnaces of Detroit and Pittsburgh, and the electric light.
I, *Private Enterprise*, am Edison, Ericsson, Goodyear, Wanamaker, Westinghouse, Fulton, Whitney, Morse, and the Wright Brothers.
I am that *Free Business*, big and little, on which civilization alone depends.
I am the body of a great spiritual entity—*Liberty*.
I am the body of a great sociological and biological fact —*Self Interest*.
It is I, *Private Enterprise*, that is winning this war for Russia, England, China, and the U. S. A.
I, *Private Enterprise*, am the power behind your son, your father, your brother fighting for you in Africa and the Pacific.
I am the Minute Man of Uncle Sam.
I am *America*.
I am the very essence and body of Jeffersonian democracy, for I am *Private Enterprise* and *Personal Liberty*."
—*Via The Wheel of Fortune, San Antonio Rotary.*

BUSINESS MUST BE FREE—FOR FREE PEOPLE*

We in this country have enjoyed the "Four Freedoms" for so long that perhaps we forget the existence of these Freedoms—and their maintenance through the years—has been largely the economic result of a Free Enterprise System.

When business is free to plan ahead, to dare, and to risk with faith in the future—with faith in the possibility of a reasonable profit, all the people benefit! When the imagination and the inventive genius of industry can forge ahead with new production methods, develop new products, and invade new markets—then mass employment and the Four Freedoms are assured.

Free Enterprise, spurred on by the Profit Motive, and operating under one traditional American Way of Life, has constantly raised the living standards of millions, created new jobs, kept wages and salaries rising, and cut the cost to the consumer of goods produced.

No dictator ever arose in a healthy, prosperous civilian economy. None ever will. Only industrial stagnation breeds those unhealthy forces of discontent that alone lead men to the destruction of their own Four Freedoms.

Industrial progress promotes Freedom, when industry in return is free of hampering government regimentation. Government must *encourage* industrial progress, not handicap its development. Repression is foreign to the conception of free people. And, because appreciation comes only from knowledge and understanding, we in Industry must explain these benefits of Free Enterprise to those who may not understand them today.

* By L. C. Blake, Advertising Manager, Curtis Mfg. Co. St. Louis, Mo.

ACTIVITIES OF THE SOCIETY

SPECIAL COMMITTEE TO CONSIDER CEMENT DIVISION*

J. B. ALEXANDER, *Chairman:* Southwestern Portland Cement Co., Osborn, Ohio.
RALSTON RUSSELL, JR.: Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
H. E. SIMPSON: Mellon Institute, Pittsburgh, Pa.
A. H. NIEMAN: Ohio Hydrate & Supply Co., Woodville, Ohio.
F. L. MARSH: National Gypsum Co., Clarence Center, N. Y.

CERAMIC EDUCATIONAL COUNCIL

Committee Chairmen for 1943–1944

Committee on Publicity: J. W. WHITTEMORE, Virginia Polytechnic Institute, Blacksburg, Va.
Committee on Definitions: A. S. WATTS, Ohio State University, Columbus, Ohio.
Committee on Curricula: C. M. DODD, Iowa State College, Ames, Iowa.
Committee on Content of Ceramic Courses: J. L. CARRUTHERS, Ohio State University, Columbus, Ohio.
Committee on Instruction in Semimicro Qualitative Analysis: M. J. RICE, New York State College of Ceramics, Alfred, N. Y.
Committee on Physical Chemistry: A. E. BADGER, University of Illinois, Urbana, Ill.
Committee on History of Ceramic Education and on Ceramic Textbooks: S. R. SCHOLES, New York State College of Ceramics, Alfred, N. Y.
Committee on Draft Status of Ceramic Students: A. I. ANDREWS, University of Illinois, Urbana, Ill.
Committee for Obtaining Recognition for Ceramic Engineering: M. E. HOLMES, New York State College of Ceramics, Alfred, N. Y.
Committee on Extension Instruction and Rehabilitation: E. P. MCNAMARA, Rutgers University, New Brunswick, N. J.

* Addition to list of Special Committees published in the June, 1943, *Bulletin*. p. 196.

INSTITUTE OF CERAMIC ENGINEERS

Executive Committee

President: H. B. DUBOIS, Consolidated Feldspar Corp., Trenton, N. J.
Vice-President: R. F. SHERWOOD, United Feldspar & Minerals Corp., New York, N. Y.
Secretary: KARL SCHWARTZWALDER, A C Spark Plug Co., Flint, Mich.
Past-President: H. M. KRANER, Bethlehem Steel Co., Bethlehem, Pa.
Trustee Representative: H. G. WOLFRAM, Porcelain Enamel & Mfg. Co., Baltimore, Md.

Committees for 1943–1944*

Committee on Education

R. M. CAMPBELL, *Chairman:* New York State College of Ceramics, Alfred, N. Y.
R. K. HURSH: University of Illinois, Urbana, Ill.
J. R. BEAM: Universal Sanitary Mfg. Co., New Castle, Pa.
G. S. DIAMOND: Electro Refractories & Alloys Corp., Lackawanna, N. Y.
J. F. McMAHON: New York State College of Ceramics, Alfred, N. Y.

Committee on Rules

M. F. BEECHER, *Chairman:* Norton Co., Worcester, Mass.
R. K. HURSH: University of Illinois, Urbana, Ill.
L. C. HEWITT: Laclede-Christy Clay Products Co., St. Louis, Mo.

* See also list of committee chairmen published in the July, 1943, *Bulletin*, p. 249.

MINUTES OF ANNUAL MEETING OF THE FELLOWS

The thirteenth annual meeting of the Fellows was held at the Hotel William Penn, Pittsburgh, Pa., at 3:00 P.M., April 18, 1943, Dean R. B. Sosman presiding.

As the minutes of the preceding meeting had been published, they were not read.[1]

Dean Sosman read his annual report[2] and emphasized new procedures for nominating and electing Fellows.

The financial report was read by the Secretary. It was pointed out that funds of the Fellows had increased approximately $300 during the year.

Dr. Scholes read the report of the Committee on History of Ceramic Education.[3] The report was accepted with the recommendation that it be called to the attention of all ceramic engineering departments with the suggestion that their history should be brought up to date.

D. E. Sharp read the report of the Committee on Rules.[4] The Committee accepted a recommendation that if a nominee for Fellowship is placed lower than tenth in order of preference by the Fellowship Board in three successive years his name shall be considered as withdrawn from further consideration. It was moved by W. A. Weldon and seconded by J. C. Hostetter that the report be accepted and the recommendations be adopted in principle. The motion was carried.

D. E. Sharp moved that the election of the first five on the preferential ballot on nominees to the Fellowship be recommended to the Trustees. The motion was seconded and carried.

W. Keith McAfee offered some suggestions regarding the reorganization of the Fellowship which were discussed informally. F. C. Flint moved (seconded by S. R. Scholes) that a committee be appointed by the Dean to study the situation and confer with the Rules Committee on the general subject of reorganization and make recommendations to the Fellows at the next annual meeting. The motion was carried.

Dr. Ries in reporting for the Committee on Geological Surveys stated that the publication of maps showing distribution of clays has been delayed because of a scarcity of draftsmen available for redrawing. Dean Sosman proposed that advice and assistance in the preparation of these maps be requested from the Geological Society of America.

F. B. Flick reported for the Committee on Patents. It was moved by Nelson Taylor (seconded by Fred Heath) that the report be published.[5] After discussion, J. C. Hostetter moved (seconded by G. E. Seil) that specific recommendations on purely legal questions be omitted. The amendment and motion were carried.

A. A. Wells and J. W. Whittemore, Chairmen of the Research and Standards Committees, respectively, stated that their reports were too long to read and would be published.[6]

The question of representation on the American Society for Testing Materials Committee C–11 on Gypsum was discussed, but decision was deferred pending further study.

Dean Sosman recommended that steps be taken to assure closer contact with the American Foundrymen's Association, particularly its research work on foundry sands.

I. A. Balinkin reported for the representation on the Inter-Society Color Council. The report was accepted.

After some discussion regarding representation on Committee C–1 on Cement of the American Society for Testing Materials and Project A–1 of the American Standards Association, it was decided to continue efforts to obtain this representation.

The tellers reported that Howells Frèchette had been elected Associate Dean for the three-year term beginning April 18, 1943.

—R. M. KING, *Secretary*

[1] See July, 1942, *Bulletin*, p. 128.
[2] See June, 1943, *Bulletin*, p. 186.
[3] See *ibid.*, p. 187. [4] See *ibid.*, p. 186. [5] See *ibid.*, p. 193.
[6] See July, 1943, *Bulletin*, p. 235, and June, 1943, *Bulletin*, p. 187, respectively.

ENAMEL DIVISION STANDARDS COMMITTEE REPORT

The need for standard tests in the field of porcelain enamels was increasingly evident during the past year, as the various Government agencies required definite specifications for the purchase of porcelain enameled articles. The National Bureau of Standards, the Enameled Utensil Manufacturers' Council, and the Porcelain Enamel Institute have aided in the establishment of specifications and tests such as the following:

Treasury Department, Procurement Division, Specification for Enamelware, Bakeshop and Kitchen, No. 523.

Treasury Department, Procurement Division, Specification for Enamelware, Hospital and Sickroom, No. 528.

Bureau of Ships, General Specification for Porcelain Enamel (for coatings).

The Office of the Quartermaster General of the War Department also has recently published a 64-page booklet entitled Inspector's Manual for Porcelain Enameled Items to acquaint inspectors and users of porcelain enameled articles with the properties and tests to be used for porcelain finishes.

The Enameled Utensil Manufacturers' Council, as a result of a cooperative research project the past three years at the University of Illinois, has adopted Commercial Standards* of the National Bureau of Standards based on the Impact Test,† Thermal-Shock Test, and Solubility Test for porcelain enamel surfaces.

The Product Standards Section of the Porcelain Enamel Institute has released as a permanent Standard the Test for Resistance of Porcelain Enamels to Gouging during the past year.‡

During the last few years, several Porcelain Enamel Institute tests have been recommended to be adopted as standards of the Enamel Division of The American Ceramic Society. Others have been proposed, but no action has been taken. It is proposed, therefore, that the Committee on Enamel Standards for 1943 review and consider all of the various tests of the National Bureau of Standards, the Porcelain Enamel Institute, the Enameled Utensil Manufacturers' Council, and other specifications of the various Government agencies for definite adoption as the Standards of the Enamel Division of The American Ceramic Society.

—R. L. COOK, *Chairman*

* Department of Commerce, Multiple-Coated Porcelain Enameled Steel Utensils. Commercial Standard CS100–42, September 30, 1942.

† Impact Test described in *Bull. Amer. Ceram. Soc.*, **22** [8] 283–86 (1943).

‡ Standard reviewed in *Ceram. Abs.*, **22** [1] 5 (1943).

PACIFIC NORTHWEST CLAY MANUFACTURERS ASSOCIATION

The summer meeting of the Pacific Northwest Clay Manufacturers Association was held in Spokane, Wash., August 7. The day was spent in visiting the Clayton and Dishman plants of the Washington Brick & Lime Company and the Mica plant of Gladding, McBean & Company.

President Howard Mansur, Washington Brick & Lime Company, presided at the dinner program. After informal introductions, A. Lee Bennett, Gladding, McBean & Company, as master of ceremonies presented a number of the members. Marion Saindon, Chehalis Brick & Tile Company, spoke of the need of research and promotional activity by brick manufacturers in their quest of postwar markets. Arthur Houlahan, Builders Brick Company, commented on present and future markets. Gordon Adderson of Gladding, McBean & Company told of some of his Company's mechanization plans. Joseph A. Pask of the Ceramic Department at the University of Washington related the activities of the Department and the University during the past year. The gathering adjourned with the drafting of A. Lee Bennett as chairman for the next meeting.

—Joseph A. Pask, *Secretary*

JOINT AUTUMN MEETING WHITE WARES AND MATERIALS AND EQUIPMENT DIVISIONS

The Autumn Meeting of the White Wares and Materials and Equipment Divisions will be held September 17 and 18 at the Summit Hotel, Uniontown, Pa. The meeting on Friday, September 17, will be devoted to steatite and Saturday's session will be on plant operation problems. Some of the following problems will be discussed.

Plant Operation Problems

(A) Labor Problems

(1) *Women employment;* (*a*) percentage increase; (*b*) speed in teaching any particular job; (*c*) quality of workmanship; (*d*) absenteeism; (*e*) effect of increase in female help on social and hygienic problems; (*f*) effect on number of accidents in plants.

(2) *Men employment;* (*a*) cooperation with management; (*b*) quality of workmanship; (*c*) absenteeism; (*d*) turnover.

(B) Plant Maintenance

(1) Shortage of millrights, electricians, carpenters, etc.

(2) Their ability.

(3) Effect of the war in obtaining required materials and parts for maintenance: (*a*) shutdowns due to these causes; (*b*) quality of material available; (*c*) old and discarded machines and equipment put back into operation; (*d*) new methods needed because of this situation.

(4) Condition of plants after the war.

(C) Fuel Conversion

(1) Conversions from one type of fuel to another due to scarcities or contemplated priorities: (*a*) success of conversions; (*b*) decrease or increase in costs; (*c*) expenditures of capital entailed.

(D) Material Storage and Conveying

(1) Storage space increase in anticipation of transportation difficulties.

(2) Installation of conveying machinery of some type.

(E) Dust Control

(1) Progress in eliminating this hazard.

(2) Trends by state legislatures to write more stringent regulations in regard to dust control.

(F) Ball Milling vs. Blunging

(G) Types of Blungers

(H) Slip Mixing vs. Dry Mixing

(I) Moisture Corrections

(J) Aging Body or Slip

(K) Weighing Procedures

(L) Types of Scales

(M) Control Measurements in Sliphouse

(N) Lawns

(O) Pumping Methods and Equipment

(P) Evacuating of Body or Slip

(Q) Filter-Pressing Methods

(R) Storage Systems

(S) Agitation

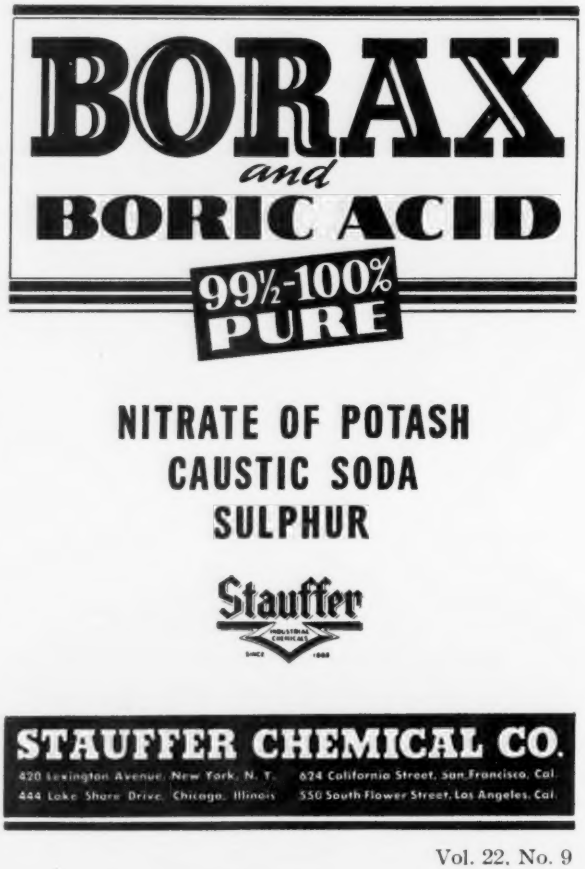
(T) Distribution Methods

WARTIME PROBLEMS OF STRUCTURAL CLAY PRODUCTS INDUSTRY

Meeting in Washington recently, the Structural Clay Products Industry Advisory Committee of the War Production Board reviewed the potential capacity, production, and inventory of the structural clay products industry and discussed its man-power and transportation problems. It was found that loss of man power has been the chief cause of the shutdown of approximately 290 clay products plants throughout the country and that the production capacity of the industry has been reduced by about one-third.

Inventories have dropped from 920 million brick in September, 1942, to 698 million brick in May, 1943. Under normal conditions, inventories increase from fall to spring to meet the peak construction demand in early summer. Approximately 50% of current inventory is frozen because of a limited demand for specific sizes and types of clay products, although all of the inventory is usable.

Following the regular meeting, the full committee met with the War Manpower Commission Subcommittee on Essential Activities. Industry members urged that the structural clay products industry be declared essential on a national war basis. This action is necessary to prevent further depletion of manpower.



OUR FORGOTTEN MAN

Most Often Forgotten by Self

(a) When Faced with Betterment Opportunities

(b) When Faced with Inimical Ideologies

He Forgets to Grasp Opportunities

And to Contend Against Inimical Ideologies

He Sacrifices Invigorating Free Enterprise for Rainbow Security

Indolently Forgetting That to Have and to Hold

Freedom from Want and Fear

He Must Buckle on His Own Armor

And Diligently Fight His Battles

In Cooperation with Other Rugged Individualists

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
January 21, 1943	2079	267	11	444	220	3021
February 21, 1943	2095	267	10	451	220	3043
March 21, 1943	1765	262	8	416	220	2671
April 21, 1943	1909	266	18	442	220	2855
May 21, 1943	1931	280	15	438	220	2884
June 21, 1943	1950	283	14	441	220	2908
July 21, 1943	1968	290	11	455	220	2944
August 21, 1943	1992	294	6	475	220	2987

MEMBERS IN SERVICE *

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(191) HARRY J. BECKEMEYER, Iowa State College, Ames, Iowa.
(192) E. J. BRIGANTI, University of Alabama, University, Ala.
(193) EUGENE C. CLEMENS, Cannelton Sewer Pipe Co., Cannelton, Ind.
(194) GEORGE R. EUSNER, Virginia Polytechnic Institute, Blacksburg, Va.
(195) HAROLD FREED, Pennsylvania State College, State College, Pa.
(196) JOSEPH FREEMAN, Pennsylvania State College, State College, Pa.
(197) JAMES J. GANGLER, University of Washington, Seattle, Wash.
(198) ALWIN J. E. HAGEDORN, John W. Higman Co., New York, N. Y.
(199) R. S. HAGERMAN, Virginia Polytechnic Institute, Blacksburg, Va.
(200) RALPH L. HAWKS, University of Washington, Seattle, Wash.
(201) ARTHUR L. POWELL, New York State College of Ceramics, Alfred, N. Y.
(202) P. W. PRICE, Victor Insulators, Inc., Victor, N. Y.
(203) CORNELIUS J. REAGAN, Pennsylvania State College, State College, Pa.
(204) RAND RODGERS, Alton Brick Co., Alton, Ill.
(205) MALCOLM A. SCHWEIKER, Rutgers University, New Brunswick, N. J.
(206) R. JACK SMITH, JR., North Carolina State College, Raleigh, N. C.
(207) J. C. STEELE, JR., J. C. Steele & Sons, Statesville, N. C.
(208) HARVEY L. TIBBALS, University of Washington, Seattle, Wash.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

NEW MEMBERS IN AUGUST

Corporation

JONES METAL PRODUCTS CO., H. C. Jurs (voter), Lafayette, Ohio.
OAK HILL FIRE BRICK CO., M. E. Davis (voter), Oak Hill, Ohio.
WORCESTER ROYAL PORCELAIN CO., LTD., Joseph F. Gimson (voter), Royal Porcelain Works, Worcester, England.

Personal

CROMER, GEORGE W., 2307 N. Calvert St., Baltimore 18, Md.; chemist, Glenn L. Martin Co.
GINGOLD, JACOB, 514 N. Alta Dr., Beverly Hills, Calif.
HAGERMAN, CAPT. R. S., 263d C.A.C., Fort Moultrie, S. C.
*HARNISH, JOHN D., JR., 401 N. Chestnut St., Derry, Pa.; ceramic engineer, Westinghouse Electric & Mfg. Co.
*MCCUTCHEN, EARL S., Engineering Experiment Station, Ohio State Univ., Columbus, Ohio.
MOTT, B. H., Mott Core Drilling Co., Huntington, W. Va.; president.
OSTROM, GUSTAF E., 533 Earlham Dr., Whittier, Calif.; director of chemical research, Chemre Corp.

Student

Ohio State University: KATHERINE E. DENNY.
Rutgers University: JAY E. COMEFORO, ALEXIS J. HANNAN, WILLIAM J. KOCH, AND PAUL S. MAYBAUM, JR.
University of Chile: LUIS GUZMAN.
University of Saskatchewan: AARON COHEN.

* Indicates former member of The Society rejoining.

ROSTER CHANGES FOR AUGUST*

ARNOLD, CHESTER L., 1415 South 47th St., Richmond, Calif. (Monaca, Pa.)
BENNETT, DWIGHT G., 204 Ceramics Bldg., Univ. of Illinois, Urbana, Ill. (Pittsburgh, Pa.)
CAITO, LT. A. M., 246 E. Maynard Ave., Columbus, Ohio (New Haven, Conn.)
FERGUSON, ROBERT F., 480 W. Fourth Ave., Columbus, Ohio (Zanesville, Ohio)
HALL, JAMES L., Metallurgical Dept., American Brake Shoe Co., Mahwah, N. J. (Chicago Heights, Ill.)
LAMBERTSON, WINGATE A., Rich Square, N. C. (Chicago, Ill.)
MCKEE, CAROLYN, 316 Fairmont Ave., New Castle, Pa. (Mahoningtown, Pa.)
MITCHELL, LT. (jg) LANE, U.S.N.R., Commander Hotel, Cambridge, Mass. (Bronx, N. Y.)
PRYOR, EDWARD K., 5745 Devenshire, Detroit 24, Mich. (Cincinnati, Ohio)
REED, ALBERT J., 215 Euclid Ave., Willard, Ohio (Pittsburgh, Pa.)
RHODES, GROVER C., Peapack Road, Box 154, Far Hills, N. J. (Peapack, N. J.)
SCHOTTS, WALTER H., 53 West Starr Ave., Columbus, Ohio (Roseville, Ohio)
SHARP, DONALD E., Libbey-Owens-Ford Glass Co., Toledo, Ohio (West Hartford, Conn.)
SMITH, GRIFFITH G., 301 Hay St., Pittsburgh 1, Pa. (Wilkinsburg, Pa.)
STEIL, ROY C., 64 Illinois St., Youngstown 4, Ohio (Des Plaines, Ill.)
WILLIAMS, ALAN B., 827 Milledge Rd., Augusta, Ga. (Painesville, Ohio)

* Address in parentheses is former address.

MEMBERSHIP WORKERS' RECORD

CORPORATION: C. E. Bales 1, J. F. Hunt 1, Felix Singer 1.

PERSONAL: C. E. Bales 2, Ralston Russell, Jr. 2, J. W. Whittemore 1, Office 2.

STUDENT: E. P. McNamara 4, W. G. Worcester 1, Office 2.

Grand Total 17.

YOUR PERSONAL SOCIETY

The American Ceramic Society is of, for, and by ceramic persons and corporations. It is theirs for the sole purpose of promoting cooperatively their ceramic welfare.

By educational and research facilities promoted by ceramic corporations and persons cooperatively, ceramics in America has forged to leadership.

For values accruing to ceramic persons and corporations, this Society has functioned for forty-five years.

PERSONAL NOTES

LORENZO ROBERT WHITAKER

Chairman, Structural Clay Products Division

Lorenzo Robert Whitaker, a descendant of several generations of circuit-riding Methodist preachers, was born January 24, 1899, in Centenary, Marion County, S. C. He attended grade school in Greenwood, S. C., and in 1916 was graduated from Reinhardt Junior College, Waleska, Ga. For four years following graduation, he worked successively as chemist for the Tennessee Copper Co., Copperhill, Tenn. (1917) and the E. I. du Pont de Nemours & Co., Hopewell, Va. (1918) and for the B. F. Goodrich Co., Akron, Ohio (1919–1920).

Lorenzo Robert Whitaker

(1943)

In 1922, Mr. Whitaker received his B.S. degree in chemistry from Emory University, Emory Univ., Ga., and spent the following four years as science teacher and coach at Decatur, Ga. (1923) and at Gainesville, Ga. (1923–1926).

After receiving a B.S. degree in ceramic engineering from North Carolina State College, Raleigh, N. C., in 1927, he was successively employed as superintendent by the Moland-Drysdale Corp., Hendersonville, N. C. (1927–1932); the Scottville Brick Co., Knoxville, Tenn. (1932); and the General Shale Products Corp., Oliver Springs, Tenn. (1933–1935). From 1936 to 1938, he was employed by the Guignard Brick Works, Columbia, S. C., as ceramic engineer. At the present time, he is associated with the Richland Shale Products Company and Carolina Ceramics, Inc., Columbia, S. C.

Mr. Whitaker has been a member of The American Ceramic Society since 1926. A licensed professional engineer in the State of South Carolina, he is also a member of Keramos, the Founder's Group of the Institute of Ceramic Engineers, and Phi Kappa Phi.

Publications (all in Brick & Clay Record)

(1) "Supplying the Architect with Special Shapes Profits the Manufacturer," **84** [6] 203–204 (1934).

(2) "Patterns for Special Shapes," **84** [7] 238–39 (1934).

(3) "Cutting Clay Shapes for Special Units," **85** [2] 62–64 (1934).

(4) "Final Steps in Making Special Shapes," **85** [3] 96 (1934).

(5) "Observations on Setting: I–IV," **86** [4] 132–33; [6] 203–204; **87** [1] 18–19 (1935); **88** [1] 26–30 (1936).

(6) "Waste-Heat Drier Fans and Flues," **89** [3] 93–95 (1936).

(7) "Draft and Fast Firing," **92** [2] 23, 27 (1938).

(8) "Drying Troubles: I–XI," **95** [5] 14–16; [6] 17–19 (1939); **96** [2] 24–25; [3] 18–20; [4] 19–21; [5] 23–24; [6] 30–31; **97** [1] 27–28; [2] 26–28; [3] 30–32; [4] 27–30 (1940).

(9) "Discussion of 'Draft in Burning Practice' by T. W. Garve": With J. G. Seanor, **97** [2] 21–22 (1940); with W. S. Sells and J. G. Seanor, **97** [3] 28–29; [4] 24–25 (1940).

(10) "Flash Brick Faster in Hot Oxidizing Fire Followed by Single Reducing Period," **98** [5] 38–40 (1941).

(11) "What's Happening Inside Your Kiln? II–XV," **100** [3] 28–30; [4] 43–44; [6] 16–17; **101** [1] 17–18; [2] 24–25; [3] 26, 28; [4] 21–22; [5] 26, 28; [6] 22–23 (1942); **102** [1] 38, 40, 42; [2] 23–25; [3] 32–34; **103** [5] 29–31; [1] 23–24 (1943).

DONALD E. SHARP WITH LIBBEY-OWENS-FORD

The Libbey-Owens-Ford Glass Company, Toledo, Ohio, has announced the appointment of Donald Ellsworth Sharp as Assistant Director of Research in charge of glass technology. Mr. Sharp, a well-known glass technologist, has had a wide and varied experience in the glass industry over a period of thirty years.*

* For a biographical sketch and other information concerning Mr. Sharp, see *Bull. Amer. Ceram. Soc.*, **17** [4] 183–84 (1938) and **22** [2] 50 (1943).

Donald Ellsworth Sharp

AARON K. LYLE SUCCEEDS SHARP

The Hartford-Empire Co., Hartford, Conn, has announced the promotion of Aaron Kerr Lyle to the position of Chief Chemist. In this position he will take over many duties formerly carried by Donald E. Sharp who has left the Company to take a position with the Libbey-Owens-Ford Glass Co., Toledo, Ohio (see opposite column).

Mr. Lyle has been with the Hartford-Empire Company since July, 1937, as Glass Technologist actively directing research on new glasses, new methods of analyzing glasses and raw materials, and developments on batch charging. He is a native of Washington, Pa., where he was graduated from Washington and Jefferson College (A.B. in 1926) and took his A.M. in 1928. He taught in the Chemistry Department of Washington and Jefferson until 1929, when he joined the technical staff of the Hazel-Atlas Glass Co., Washington, Pa., with which Company he was associated until 1934, when he accepted a position as chemist with the Bailey and Sharp Company, Consulting Glass Technologists of Hamburg, N. Y. He held this position until he joined the staff of the Hartford-Empire Company in 1937.

Aaron Kerr Lyle

Mr. Lyle has published many scientific and technical papers in the field of glass technology. These deal with analytical methods, chemical durability, convection in melting furnaces, and a new system of melting batch. He is also the inventor of new glasses and improvements for melting units for which numerous patents have been granted. He is active in The American Ceramic Society, having been Chairman of the Glass Division and elected Fellow in 1941, and is prominent in the Glass Committee of A.S.T.M. as a member of several of its subcommittees.

D. G. BENNETT SPECIAL RESEARCH PROFESSOR

Dwight G. Bennett, a graduate of the Department of Ceramic Engineering at the University of Illinois, Urbana, Ill., in 1930, is returning to the University to undertake research in connection with a cooperative arrangement between the Army Air Force and the Engineering Experiment Station at the University. This research involves the development and study of the use of ceramic coatings on exhaust systems for airplanes. It will include both laboratory and actual service tests and a study of certain special properties of these coatings.* Professor Bennett is on leave of absence from the Enamels Fellowship at Mellon Institute, Pittsburgh, Pa., where he has been employed for twelve years.†

* This research project is described more fully in *Bull. Amer. Ceram. Soc.*, **22** [8] 276 (1943). See also notice of C. M. Andrews' work on opposite page.

† For a biographical sketch of Professor Bennett, see *ibid.*, **22** [6] 198 (1943).

CLYDE LOWRY THOMPSON

Chairman, Refractories Division

Biography

Clyde Lowry Thompson was born near Mt. Vernon, Ill., April 22, 1903. He was educated in the public schools of Mt. Vernon and at the University of Illinois. At the latter institution he received the degrees of B.S. (1927) and M.S. (1930) in Ceramic Engineering and Ph.D. in Engineering (1936).

Clyde Lowry Thompson

He served as Graduate Research Assistant (1927–1928), Instructor (1928–1933), and Associate (1933–1936) in Ceramic Engineering at the University of Illinois. While at Illinois, he worked for the Illinois State Geological Survey, the Ludowici-Celadon Company, and the Harbison-Walker Refractories Company during summer vacations and did testing and research work for the Standard Sanitary Manufacturing Company, the Findlay Clay Products Company, and others. Since 1936, he has been manager of Hays Laboratory of the Harbison-Walker Refractories Co., Pittsburgh, Pa.

He has been a member of The American Ceramic Society since 1926 and a Fellow since 1935. In addition to his present chairmanship of the Refractories Division, he has served as secretary and vice-chairman of that Division and as secretary, vice-chairman, and chairman of the Pittsburgh Section. He is also a member of the American Mineralogical Society, American Association for the Advancement of Science, Sigma Xi, Tau Beta Pi, Sigma Tau, Phi Kappa Phi, and Keramos.

Publications

(1) (With T. N. McVay) "X-Ray Investigation of Effect of Heat on China Clays," *Jour. Amer. Ceram. Soc.*, **11** [11] 829–41 (1928).

(2) "Microstructure of Some Porcelain Glazes," *Univ. Ill. Eng. Expt. Sta. Bull.*, No. 225 (1931).

(3) "Quantitative Microscopic Determination of Quartz Content of Some Commercial Feldspars," *Jour. Amer. Ceram. Soc.*, **17** [8] 257–58 (1934).

(4) "Effect of Kind of Flint Used on Some Properties of a Hotel China Body," *ibid.*, [9] 268–71.

(5) "Influence of Silica Content upon Properties of Refractories (abstract of a thesis), Urbana, Ill. (1936).

(6) "Identification of Stones in Glass," *Glass Ind.*, **17** [7] 236 (1936).

(7) (With C. W. Parmelee) "Effect of Heat-Treatment on Thermal Expansion of Some Silica-Alumina Glasses," *Jour. Amer. Ceram. Soc.*, **20** [9] 305–308 (1937).

(8) (With E. P. Rexford) "Study of Alumina-Silica Checker Brick from a Glass Tank Regenerator," *ibid.*, **21** [2] 55–59 (1938).

(9) (With C. W. Parmelee) "Effect of Boron Oxide, Phosphorous Pentoxide, and Ferric Oxide on Thermal Expansion of a Florida Kaolin-Quartz Mixture," *ibid.*, **22** [5] 170–72 (1939).

(10) (With H. G. Wilcox) "High-Temperature Gas-Fired Test Furnace," *Bull. Amer. Ceram. Soc.*, **19** [9] 336–37 (1940).

(11) "Control of Atmosphere in Laboratory Kilns," *ibid.*, **22** [9] 302–304 (1943).

EDWARD P. McNAMARA

Edward P. McNamara has been appointed Acting Director of the Department of Ceramics at Rutgers University, New Brunswick, N. J., and will carry on the work of George H. Brown, who died February 8, 1943. Professor McNamara has been a member of the Department staff since September, 1942.

A photograph of Professor McNamara and a review of his collegiate training and teaching activities have been published in a previous issue of *The Bulletin* (see *Bull. Amer. Ceram. Soc.*, **19** [3] 115 (1940)).

C. M. ANDREWS TO ILLINOIS FOR GOVERNMENT COOPERATIVE RESEARCH

Clifford M. Andrews, a 1934 graduate of the Department of Ceramic Engineering, University of Illinois, Urbana, Ill., and enamel superintendent at the McRay Refrigerator Co., Kendallville, Ind., has been granted a leave of absence of one year to return to the Department of Ceramic Engineering as Special Research Assistant Professor. Professor Andrews is to work on the Army Air Force project dealing with ceramic coatings for exhaust systems on airplanes.

EUGENE P. HARTER

Eugene P. Harter has been made general sales manager of the Electro Refractories & Alloys Corp., Buffalo, N. Y., manufacturers of silicon carbide crucibles, high-temperature steel-mill and foundry refractories and cements, grinding wheels, silicon carbide enamel-furnace muffles, tunnel-kiln furniture, and other electric-furnace products and special alloys.

Before joining the Electro organization in June, 1941, Mr. Harter spent several years in sales and administrative work with the Universal-Cyclops Steel Corp., Titusville, Pa., manufacturers of tool and stainless steels.

In October, 1941, Mr. Harter was appointed sales manager of the Grinding Wheel Division, in which capacity he served until the present time. In his new capacity as general sales manager for the Corporation, he assumes full sales management of Electro's complete line of products for domestic, Canadian, and foreign markets and takes over the sales administrative duties of Grant S. Diamond, vice-president, who now assumes greater executive and management responsibilities as the result of the recent death of Luke U. Milward, president.

Mr. Harter is a native of Syracuse, N. Y., and holds an A.B. degree from Colgate University, Hamilton, N. Y. He is a member of the Buffalo Athletic Club and the Buffalo Chamber of Commerce.

NECROLOGY

ROBERT LEVI HARE

Robert Levi Hare, proprietor and operator of The Wyandot Clay Products Co., Upper Sandusky, Ohio, died suddenly July 15, 1943, in the Hollenden Hotel, Cleveland, Ohio. Death was attributed to coronary occlusion. Mr. Hare had driven to Cleveland and had just arrived at the Hotel, when he went into a telephone booth to place a call. Shortly after entering the booth he was seen to slump to the floor by a man waiting on the outside to use the telephone. A doctor was summoned along with the Cleveland police rescue squad, but death had resulted before their arrival.

Mr. Hare was born in Upper Sandusky November 1, 1884, the son of the late Cyrus D. and Mary McCutchan Hare. He attended the local public schools and was graduated from Upper Sandusky High School in 1903. In 1908, he was graduated from Ohio State University, Columbus, Ohio, with a degree in ceramic engineering. Following his graduation, he became superintendent of the Cobb Brick & Tile Co., Fort Worth, Texas. Some time later, he was made manager of the brick plant at Collinsville, Okla. Before returning to Upper Sandusky in 1919, he was connected with the A. P. Green Fire Brick Co., Mexico, Mo.

On September 19, 1919, he bought the Blaser Tile and Brick plant and started The Wyandot Clay Products Company, which was to become one of the largest industries of its kind in this section of the country. It became known for its sand-molded brick, the type of brick specified by most of the leading architects of the country.

Mr. Hare had been a member of The American Ceramic Society since 1909. He was also a member of the Masonic lodge and Elks lodge in Upper Sandusky.

He is survived by his widow, Mrs. Jane Sears Hare, one daughter, and three sisters.

LAURA ANNE FRY

Tribute from Purdue University*

Laura Anne Fry, for many years an outstanding personage on the faculty of Purdue University, Lafayette, Ind., died at her home near Cincinnati, Ohio, on July 30, 1943, at the age of eighty-five.

Miss Fry was an artist of outstanding ability and a member of a noted family of artists. Her father, William Fry, who died in 1929 at the age of ninety-nine, was a distinguished wood carver and sculptor and an instructor in the Art Academy of Cincinnati. Miss Fry was a native Hoosier, born near Monticello, Ind., but the family moved to Cincinnati when she was quite young, and she grew up in the artistic atmosphere of that city.

Her talents and her family traditions naturally took her into the field of art. She studied at the Art Academy under such notable artists as Frank Duveneck, William Chase, and Kenyon Cox. On graduation from the Academy, she taught china painting in private schools. She became associated with the Rookwood Pottery at the time of its founding and enjoyed in Cincinnati the reputation of one of its principal artists.

Miss Fry came to Purdue in 1891 as Professor of Industrial Art and for over thirty years taught generations of students wood carving, china painting, design, and decoration. Her courses were designed to train the artistic sense and develop skill in artistic expression in drawing and sketching. She really was more than a Professor of Industrial Art; she was a fine artist, and she brought to her work the enthusiasm of the artist for beauty.

Though personally conservative in taste, she was liberal in her approach to art. Art to her was life, many-sided, capable of sheltering all schools of thought. Her pupils learned not to make hasty judgments about unorthodox methods and techniques, but to find out for themselves what the unorthodox was trying to say.

Her studio and workroom in the Ladies Hall was one of the landmarks of the Purdue of her time. She was a highly successful teacher, who was able to inspire in her students something beyond utilitarian standards. Her work in sculpture and ceramics was well known in national circles and was exhibited in galleries throughout the country. She founded the Ceramic Art Club of Lafayette and was an active mover in the Lafayette Art Association.

Miss Fry retired from Purdue in 1922 under the terms of the Carnegie Foundation and spent the rest of her life in Terrace Park, a suburb of Cincinnati, where she lived with her sister, Mrs. Lillie Fry Fisher, also at one time a member of the Purdue faculty. There, with the vitality so marked in her family, she carried on her work as an active artist. Seven years ago she fractured her hip and since had been confined to her bed, but she continued to work daily, putting aside her last piece of work only ten days before her death.

Miss Fry's term of teaching at Purdue began over fifty years ago when Purdue was passing out of its formative stages. She saw the second half of President Smart's administration and served throughout the entire period of President Stone's. During these years, Purdue was growing rapidly in numbers and influence. To this growth Miss Fry, within her field, made a notable contribution. Purdue, though preeminently a man's school, has always been fortunate in attracting outstanding women to its staff. Miss Fry stood securely in this group. Her strong native character, her devotion to art, her outstanding reputation in her field, made a lasting imprint on the University.

—R. G. DUKES, EDITH GAMBLE, H. E. ENDERS, BLANCHE MILLER, J. A. ESTEY, *Chairman*

LEONARD A. DENISON

A short illness ended July 19, 1943, in the death at Lakeside Hospital of Leonard A. Denison, vice-president of the Ohio Clay Co., Cleveland, Ohio, and a leader in Cleveland business for many years. Mr. Denison had also been prominent in East Cleveland civic affairs and had been on the board of the East Cleveland Y.M.C.A. and a member of the East Cleveland Rotary Club.

A native of Mt. Gilead, Ohio, Mr. Denison went to Cleveland with his family in 1906* and attended Shaw High School and later was graduated from the Asheville School for Boys at Asheville, N. C. He later studied at Rensselaer Polytechnic Institute, Troy, N. Y., where he was a member of Delta Phi fraternity. During the last World War, he served overseas in the Engineer Corps for eighteen months.

Surviving Mr. Denison are his widow, Mrs. Helen Vail Denison; his children, David and Jill; his parents, Mr. and Mrs. William C. Denison; his brothers, George W., vice-president of the Ohio Clay Company at Bay Village, and William C. Denison, Jr., president of the Denison Engineering Co., Columbus, Ohio; and a sister, Mrs. Eva Denison Neale.

* See also *Bull. Amer. Ceram. Soc.*, **17** [9] 368–72(1938) (biographical sketch and photo) and **19** [7] 278 (1940).

* At the time the Ohio Clay Company was formed by W. C. Denison (Mr. Denison's father and president of the Company) and J. F. and L. L. Denison (see *Bull. Amer. Ceram. Soc.*, **22** [6] 167–72 (1943)).

Leonard A. Denison

GORDON KLEIN

Gordon Klein, 46, manager of the New Castle (Pa.) Refractories Co., died May 2, 1942. Mr. Klein was a University of Illinois graduate, Department of Ceramic Engineering, and had been with the New Castle Refractories Company since 1925.

Gordon Klein

MIRROR MURALS BY PITTSBURGH PLATE

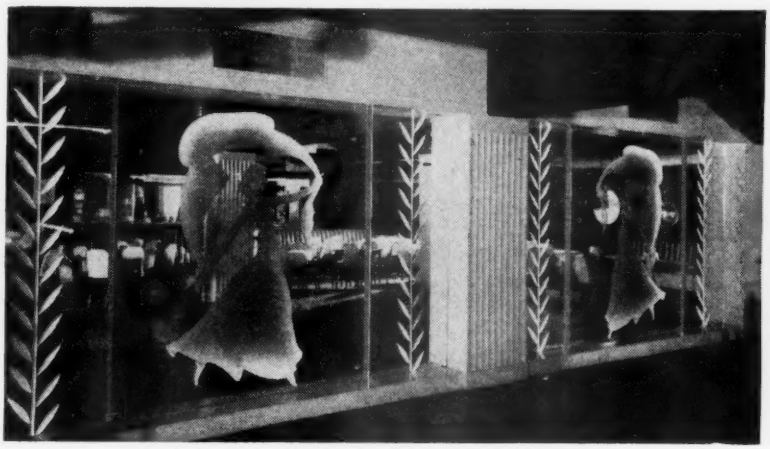
The largest edge-lighted mirror murals ever built have been installed in the cocktail lounge of the Penn-McKee Hotel, McKeesport, Pa. The central theme, a life-sized Greek dancing girl, was sandblasted on a single piece of polished plate glass $^1/_2$ in. thick, 7 ft. 5 in. high, and 6 ft. 10 in. wide. Edge-lighted by concealed neon fluorescent lamps on all four edges, the panel is supported by hidden brackets that do not permit it to come in contact with the lamp tubes.

Flanking this central design are two smaller decorative panels 3 ft. wide, also sandblasted and edge-lighted. All of the glass is silvered on the sandblasted surface. The entire installation consists of two murals of exactly the same design placed between three fluted pilasters painted eggshell white. It extends for more than 30 ft. along the wall.

The Studio of Creative Design of the Pittsburgh Plate Glass Co., Pittsburgh, Pa., created the sketches; the sandblasting and silvering work was done at its Ford City plant. After an enlargment of the artist's original sketch was placed on the large piece of plate glass, the rest of the surface was masked. The sandblasting was then executed by men as skilled with the sandblast as a sculptor with his chisel. The silvering covers the design as well as the smooth surface.

The Penn-McKee mirror mural is an example of both the dynamic and decorative results possible with a combination of mirrors and edge-lighting. Mirrors backed with copper, gold, gun metal, or conventional silver, plain or sandblasted, and given life by white or colored neon fluorescent lights at the edges, offer numerous effects in either mood or theme.

In the lounge all lights are soft and indirect; each mirror panel receives its illumination only through its edges; hence the entire mural appears to be suspended in air and its glowing figures to be in graceful motion. An added effect of spaciousness is achieved by the reflection of the whole room in the mural.



Mirror mural in Penn-McKee cocktail lounge

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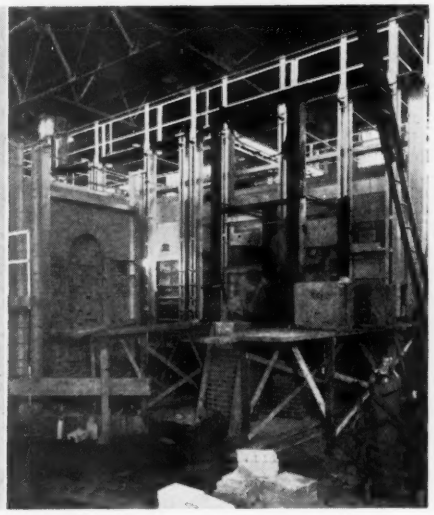

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Carborundum Co.
Electro Refractories & Alloys Corp.
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Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

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Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

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Drakenfeld, B. F., & Co.
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The Hommel, O., Co., Inc.

Bone Ash
Harshaw Chemical Co.
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Pacific Coast Borax Co.
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Borax Glass
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Du Pont de Nemours, E. I., & Co. Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
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Harshaw Chemical Co.
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Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.

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Great Lakes Foundry Sand Co.

Clay (Block)
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Harshaw Chemical Co.
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The Vitro Mfg. Co.

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Clay (Electrical Porcelain)
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Harshaw Chemical Co.
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Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Potters Supply Co.

Clay (German Vallendar)
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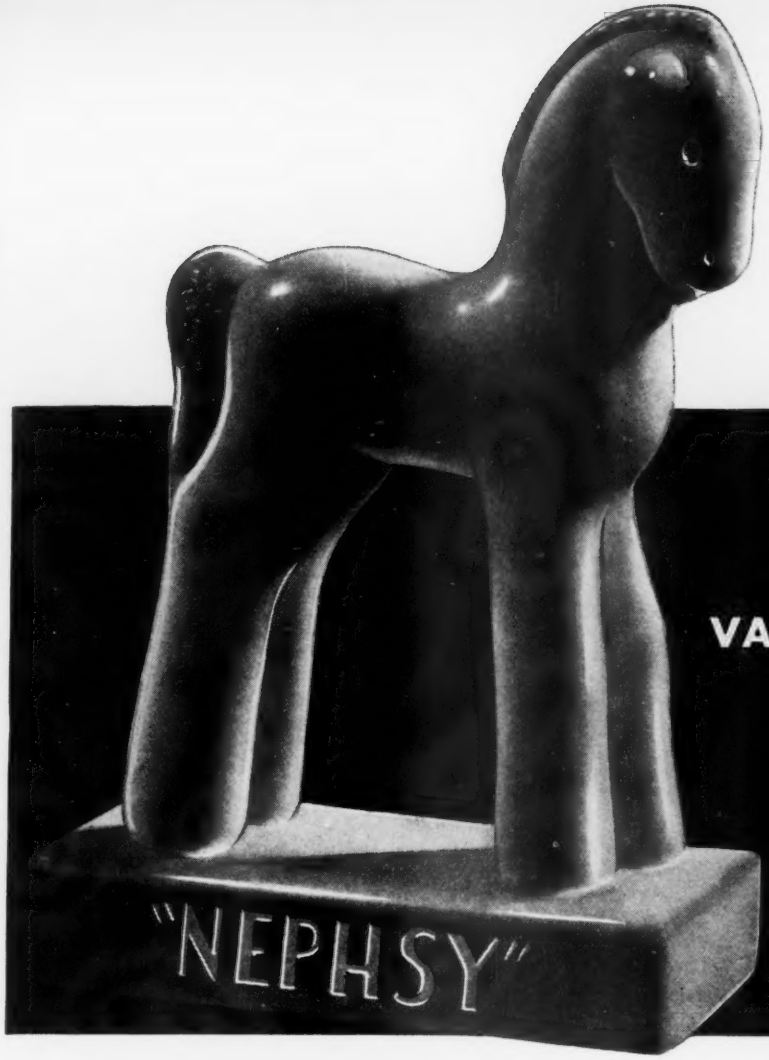
Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.



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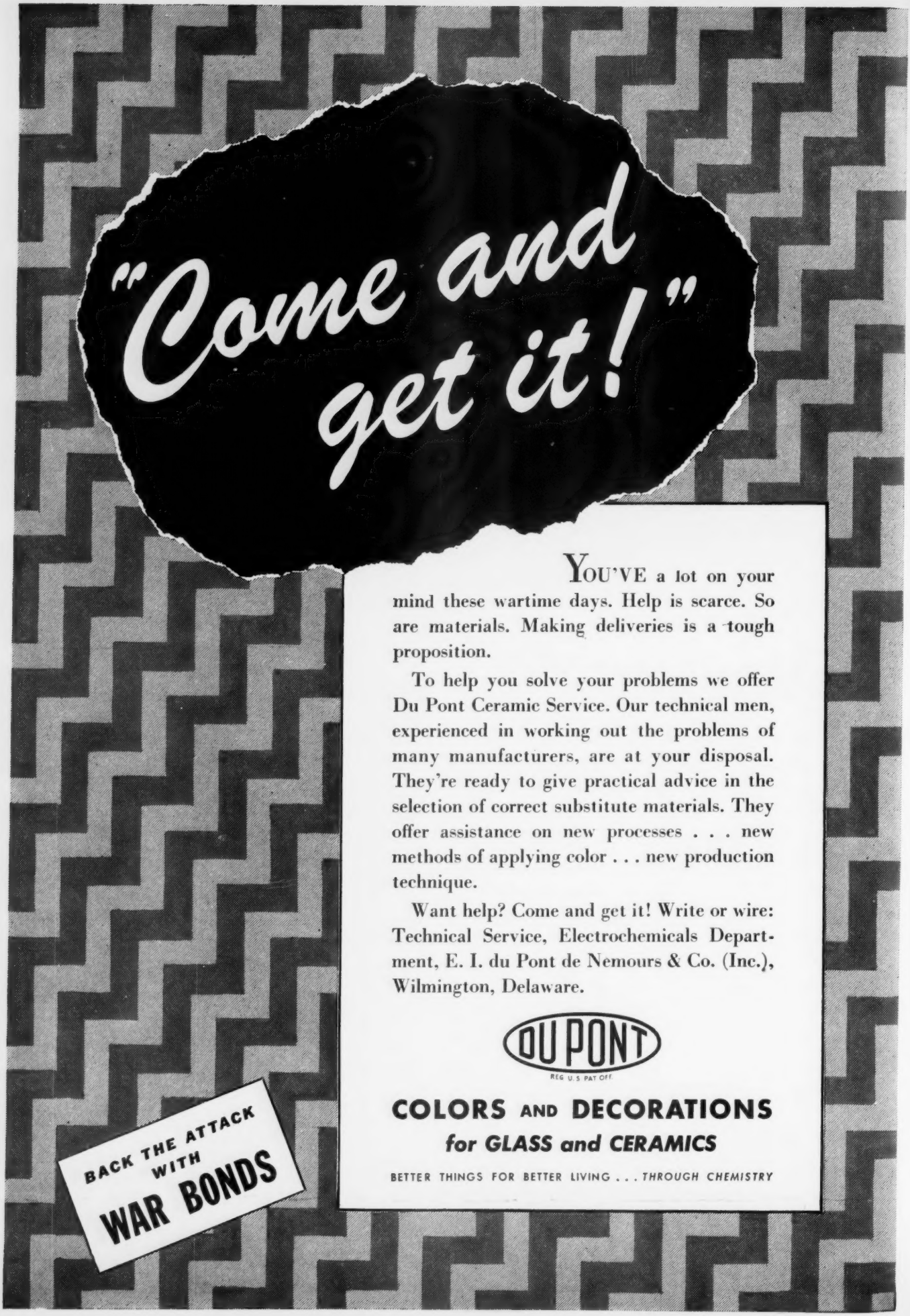
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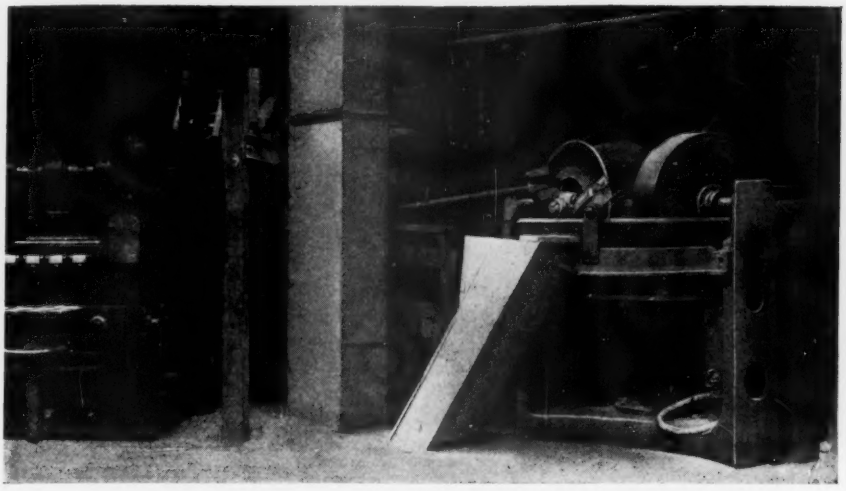

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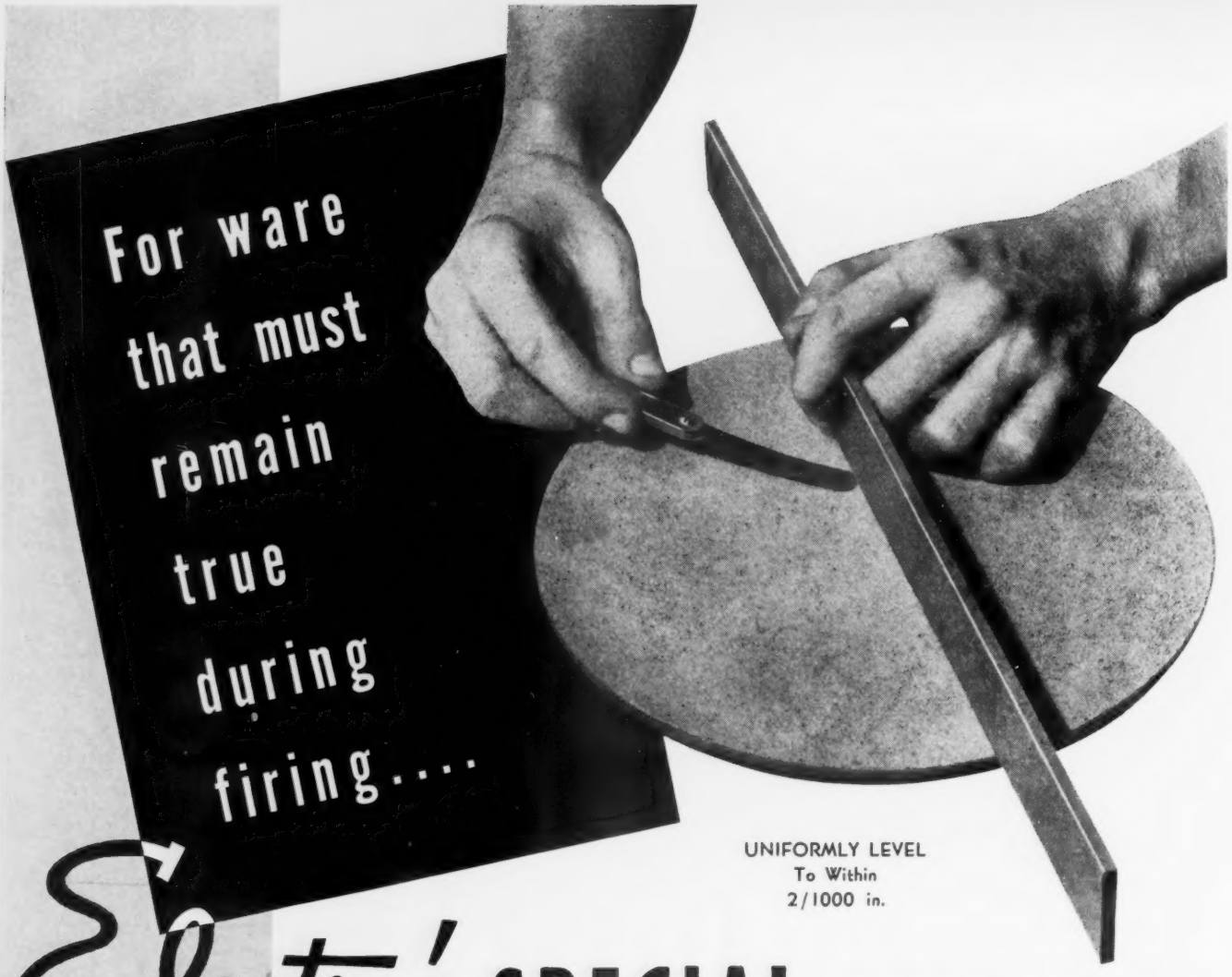

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The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

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Potters Supply Co.

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Leeds & Northrup Co.

Refractometers
Bausch & Lomb Optical Co.
Electro Refractories & Alloys Corp.

Refractories
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Refractory Materials
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Titanium Alloy & Mfg. Co.

Respirators
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.

Rutile
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Sand
Great Lakes Foundry Sand Co.

Sand Grinders and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel, O., Co., Inc.

Saws: Diamond impregnated for cutting off
Felker Mfg. Co.

Screening and Magnetic Separators
National Engineering Co.

Selenite of Sodium
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Selenium
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel O., Co., Inc.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
Foote Mineral Co.
The Hommel, O., Co., Inc.

Silicate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Soda Ash
American Potash & Chemical Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Drakenfeld, B. F., & Co
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Silica Fluoride
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Spray Booths
The Hommel, O., Co., Inc.

Spraying Equipment
The Hommel, O., Co., Inc.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Lancaster Iron Works, Inc.

Stilts
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Sulfur
Stauffer Chemical Co.

Sulfuric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.

Talc
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
International Pulp Company

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
The Hommel, O., Co., Inc.

Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co., (*Carbofrax*)
Electro Refractories & Alloys Corp.
Norton Co.

Tin Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Drakenfeld, B. F. & Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Electro Refractories & Alloys Corp.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.
The Hommel, O., Co., Inc.

Zirconia
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
The Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

Zirkite (Natural ZrO_2)
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